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John

Cocker's
ARITHMETICK:

BEING

A plain and familiar Method, ſuitable to the meaneſt Capacity for the full underſtanding of that Incomparable Art, as it is now taught by the ableſt School-Maſters in City and Country.

COMPOSED

By *Edward Cocker*, late Practitioner in the Arts of VVriting, Arithmetick, and Engraving. Being that ſo long ſince promiſed to the World.

PERUSED and PUBLISHED

By *John Hawkins* Writing-Maſter near St. *Georges* Church in *Southwark*, by the Authors correct Coppy, and commended to the World by many eminent Mathematicians and Writing-Maſters in and near *London*.

This Impreſſion is corrected and amended, with many Additions throughout the Whole.

Licenſed *Sept.* 3. 1677. *Roger L'Eſtrange.*

LONDON,
Printed by *J. R.* for *Eben Tracey*, at the *Three Bibles* on *London-Bridge.* 1697.

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TO his much Honoured Friends, *Manwaring Davies* of the *Inner Temple*, Eſquire; and Mr. *Humphry Davies* of St. *Mary Newingon-Buts'* in the County of *Surry*.

John Hawkins, As an Acknowledgment of unmerited Favours, humbly Didicateth this *Manael of Arithmetick*. Blor

To the READER.

C

Courteous Reader.

I Having the Happineſs of an Intimate Al
quaintance with Mr. *Cocker* in his Lif
time often ſolicited him to remember h
Promiſe to the World, of Publiſhing his A
rithmetick, but (for Reaſons beſt known
himſelf) he refuſed it; and (after his Deat
the Copy falling accidentally into my hand
I thought it not convenient to ſmoother a Wo
of ſo conſiderable a moment, not queſtioni
but it might be as kindly accepted, as if
had been preſented by his own hand. T
Method is familiar and eaſie, diſcovering
well the Theorick as the Practick of th
Neceſſary Art of Vulgar *Arithmetick*: And i
this new Edition there are many remarkab
Alterations for the benefit of the Teacher
Learner, which I hope will be very accept
ble to the World: I have alſo perform
my promiſe in Publiſhing the *Decimal Arit
metick*, which finds encouragement to my E
pectation, and the Bookſellers too, I am

Thi

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W

Mr. *Edward Cocker's*

PROEME or PREFACE.

BY the ſacred Influence of Divine Providence, I have been Inſtrumental to the benefit of many; by vertue of thoſe uſefull Arts, Writing *and* Engraving : *And do now with the ſame wonted alacrity caſt this my Arithmetical Mite into the Publick Treaſury, beſeeching the Almighty to grant the like bleſſing to theſe as to my former Labours.*

Cmili

Seven Sciences ſupremely excellent,
Are the chief Stars in Wiſdoms Firmament :
Whereof Arithmetick is one. whoſe worth
The Beams of Profit and Delight ſhines forth ;
This crowns the reſt ; this makes man's mind complete ;
This treats of Numbers, and of this we treat.

initze

I have been often deſired by my intimate Friends to publiſh ſomething on this ſubject ; who in a pleaſing Freedom have ſignified to me that they expected it would be extraordinary. How far I have anſwered their Expectation, I know not ; but this I know, that I have deſigned this Work, not extraordinary abſtruſe or profound,

profound, but have by all means poſſible withi the Circumference of my Capacity, endeavou red to render it extraordinary aſeful to all thoſe whoſe Occaſions ſhall induce them to make uſe o Numbers. If it be objected that the Books already publiſhed, treating of Numbers are innumerable, I anſwer that's but a ſmall wonder, ſince the Art is infinite. But that ther ſhould be ſo many excellent Tracts of Practica Arithmetick extant, and ſo little practiſed, i to me a greater wonder; knowing that as Merchandiſe is the Life of the Weal-Publick; ſ Practical Arithmetick is the Soul of Marchandiſe. Therefore I do ingenuouſly profeſs, tha in the beginning of this undertaking, the unmerous Concerns of the honoured Merchants firſt poſſeſſed my Conſideration: And how far I have accommodated this Compoſure for his moſt worthy Service, let his own profitable experience be judge.

Secondly, *For your Service, moſt excellent Profeſſors, whoſe underſtandings ſoar to the ſublimity of the Theory and Practice of this Noble Science, was this Arithmetical Tractate compoſed; which you may pleaſe to imploy as a Monitor to inſtruct your young* Tyores, *and thereby take occaſion to reſerve your precious moments, which might be exhauſted that way, for your more important Affairs.*

Thirdly, for you, the ingenious off ſpring of happy Parents, who will willingly pay the full Price of Induſtry and Evercise for thoſe Arts and choice Accompliſhments which may contribute to the Felicity of your future State. For you, I ſay, (ingenious Practitioners) was this Work compoſed, which may prove the Pleaſure of your Youth, and the Glory of your Age.

Laſtly, For you the pretended Numeriſts of this vapouring Age, who are more diſingeniouſly witty to propound unneceſſary Queſtions, than ingeniouſly judicious to reſolve ſuch as are neceſſary. For you was this Book compoſed and publiſhed, if you will deny your ſelves ſo much as to invert the ſtreams of your ingenuity, and by ſtudiouſly conferring with the Notes, Names, Orders, Progreſs, Species, Properties, Proprieties, Proportions, Powers, Affections and Applications of Numbers delivered herein, become ſuch Artiſts indeed, as you now only ſeem to be. This Arithmetick ingeniouſly obſerved, and diligently practiſed, will turn to good account to all that ſhall be concerned in Accompts. All whoſe Rules are grounded on verity and delivered with Sincerity. The Examples are built up gradually from the ſmalleſt conſideration to the greateſt. All the Problems or Propoſitions are well weighed, pertinent, and clear, and not one of *them throughout the Tract taken upon truſt therefore now,*

Zoilus and *Momus* lie you down and dye,
For theſe Inventions your whole force defye

Edward Cocker

Edward Cocker

Courteou

Courteous Reader.

Being well Acquainted with the deceaſed Author, and finding him knowing and ſtudious in the Myſteries of Numbers and Algebra, of which he had ſome choice Manuſcripts, and a great Collection of Printed Authors in ſeveral Languages. I doubt not but he hath writ his Arithmetick ſuitable to his own Preface, and worthy acceptation, which I thought to certifie on a requeſt to that purpoſe made to him that wiſheth thy Welfare, and the Progreſs of Arts.

John Collens.

November 27th. 1677.

This Manual of Arithmetick is recommended to the World by Us whoſe Names are ſubſcribed, viz.

Mr. *John Collens*
Mr. *James Atkinſon*
Mr. *Peter Perkins* } Matth.
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Mr. *Eleazer Wigan*
Mr. *Rich. Noble* of *Guilford*
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Mr. *Joſeph Symmonds*
Mr. *Jerem. Milles*
Mr. *Joſiah Cuffley*
Mr. *John Hawkins*

And generally Approved by all Ingenious Artiſts.

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CHAP

CHAP. I.

Notation of Numbers.

A*Rithmetick* is an Art of Numbring or Knowledge, which teacheth to number well, (*viz.*) the Doctrine of Accounting by Numbers. And there are divers Species and kinds of Arithmetick and Geometry, the which we do intend o treat of in order ; applying the Principles of the ne to the Definitions of the other : For as Magnitude r Greatneſs is the ſubject of Geometry, ſo Multitude r Number is the ſubject of Arithmetick ; and if ſo, hen their firſt Principles and chief Fundamentals, nuſt have like Definitions ; or at leaſt, a Semblable ongruency.

2. Number, is that by which the Quantity of any hing is Expreſſed or Numbred ; as the Unit is the umber by which the quantity of one thing is expreſſed r ſaid to be one, and two by which it is named two, nd $\frac{1}{2}$ half by which it is named or called half, and the oot of 3, by which it is called the Root of 3, the like f any other.

3. Hence it is that Unit is Number, for the part is f the ſame matter that is his whole, the Unite is art of the Multitude of Units, therefore the Unit is f the ſame matter that is the Multitude of Units ; ut the matter of the Multitude of Units is number, herefore the matter of Unit is number ; for elſe if om a given number, no number, be ſubſtracted, the umber given, remaineth ; let three be the number given, from which number ſubſtract or take away one which as ſome conceive is no number) therefore the

number given remaineth, that is to ſay, there remain-eth three, which is abſurd.

4. Hence it will be convenient to examine fro whence Number hath its Riſe or Beginning: Moſt Au-thors maintain that Unit is the Beginning of Number and it ſelf no number; but looking upon the Princi-ples and Definitions in the firſt rudiments of Geome-try, we ſhall find, that the definition of a Point is i no way congruous with the Definition of an Unit i Arithmetick; and therefore one, or Unit muſt be i the bounds or limits of Number, and conſequentl the beginning of Number is not to be found in th number one; wherefore to make number and magni-tude congruent in Principles, and like in Definitions we make and conſtitute a Cypher to be the beginnin of number, or rather the medium between encreaſin and decreaſing numbers, commonly called abſolute o whole Numbers, and negative or fractional numbers between which nothing can be imagined more agreea-ble to the definition of a point in Geometry; for as point is an adjunct of number and it ſelf no line, ſo (o) Cypher an adjunct of number and it ſelf no num-ber: And as a point in Geometry cannot be divided increaſed into parts; ſo likewiſe (o) cannot be divide or increaſed into parts; for as many points though i number infinite do make no line, ſo many (o) Cy-phers, though in number infinite do make no number. For the line AB cannot be increaſed by the addition of the point C, neither can the number D be increaſed by the addition of the (o) Cypher E, for if you add nothing to 6, the Sum will be 6, (o) neither increaſing nor diminiſhing the number 6, but if it be granted that A B be extended or prolonged to the point C, ſo that A C be made a continued line, then A B is increaſed by the addition of the point C, in like man-

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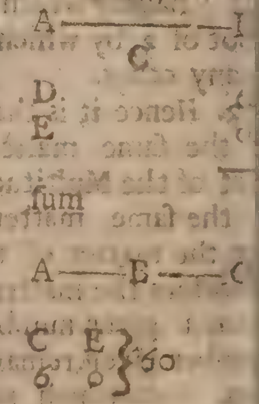


er if we grant D 5 be prolonged to E (o) ſo that D E
60) be a continued number making 60, then 6 is aug-
nented by the aid of (o) as to the conſtituting the num-
er, (60) ſixty; and furthermore that one or unit is
naterial and a number, and that (o) is the beginning of
umber is proved by all Authors altho' indirectly, for
e Tables of Sines and Tangents prove one degree to
e a number, becauſe the Sine of 1 degree is 174524
the Radius being 10000000) and the beginning of
hat Table is (o) and to it anſwereth 00000, *&c.*

5. Hence it is that number is not quantity diſcon-
inued, for all that which is but one quantity, is not
uantity disjunct; (60) ſixty as it is a number, is one
uantity, *viz.* one number (60) ſixty; therefore as it
number, it is not quantity disjunct; for number, is
me ſuch thing in Magnitude, as humidity in Water;
r as humidity extend it ſelf through all and every
rt of Water, ſo number related to Mgnitude, doth
xtends it ſelf through all and every part of Magnitude.
lſo as to continued Water doth anſwer continued
umidity, ſo to a continued Magnitude doth anſwer a
ntinued number. As the continued Humidity of
y intire Water, ſuffereth the ſame Diviſion and
ſtinction that his Water doth; ſo the continued
umber ſuffereth the ſame Diviſion and Diſtinction
at his Magnitude doth. From all which Conſidera-
ns we might enlarge a further Digreſſion concern-
g Number and Magnitude, by comparing the Defini-
ns of the one with the Principles of the other, for
ving found a (o) Cypher to be anſwerable in Defini-
n to a point in Magnitude, we may very well con-
de that number may be congruent to a line; as alſo
Figurative Number to be conſonant in Definition
th a Superficies, and Solid, *&c.* in the order of
ometrical Magnitudes.

5. The Characters or Notes by which Numbers are
nified, or by which a Number is ordinarily expreſſed
theſe following, (*viz.*) o Cypher or nothing, 1 One
Two, 3 Three, 4 Four, 5 Five, 6 Six, 7 Seven
Eight, 9 Nine: The Cypher, which though of it

ſelf ſignifieth nothing (*viz.*) expreſſeth not any certa or known quantity,but is the beginning,Radix,or Ro of Number, and the other nine Figures or Characte are called ſignificant Figures or Digits.

7. In numbers of any ſort, two things are to conſidered, (*viz.*) Notation and Numeration.

8. Notation teacheth how to deſcribe any Numb by certain Notes and Characters, and to declare th value thereof being ſo deſcribed, and that is by De grees and Periods.

9. A degree conſiſts of three figures, *viz.* of thre places comprehending Units, Tens and Hundreds, 365 is a degree, and the firſt figure (5) on the righ hand, ſtands ſimply for its own value, being Units ſo many ones (*viz.*) five; the ſecond in order from the right, ſignifies as many times ten, as there ar unites contained in it, (*viz.*) ſixty; the third in th ſame order ſignifies ſo many hundreds as it contain Units, ſo will the expreſſion of the Number be, thre hundred ſixty five; alſo 789, is ſeven hundred eight nine, &c.

10. A Period is when a Number conſiſts of mor than three figures, or places, and whoſe proper orde is to prick or diſtinguiſh every third Place beginning a the right hand, and ſo on to the left; ſo the Numbe 63452 being given, it will be diſtinguiſhed thu 63.451, and expreſſed thus, ſixty three thouſand fou hundred fifty two, likewiſe 4.578.236.782, being di ſtinguiſhed, as you ſee will be expreſſed thus, fou thouſand five hundred ſeven eight Millions, tw hundred thirty five thouſand, ſeven hundred eight two.

11. Number is either Abſolute or Negative.

12. An Abſolute, or intire, whole, increaſing Number, is that which by annexing of another Figure c Cypher it becomes ten times as much as it ſtood fo before; and if two Figures or Cyphers be annexed, i makes it a hundred times more than it ſtood for before, &c. as if you annex to the Figure 6 a Cypher then it will become (60) ſixty: So if two Cyphers are

annexe

annexed, then it will be (600) ſix hundred, and if you do annex to it a (4) four, then it will be (64) ſixty four; and if you annex (78) ſeventy eight, it will be then (678) ſix hundred ſeventy eight, and ſo on: By annexing more Figures or Cyphers, it will encreaſe in a decuple proportion *ad Infinitum.*

13. A Negative, or Broken, Fractional, Decreaſing Number, is that which by prefixing a Point or Prick towards the left hand its value is decreaſed from ſo many Units, to ſo many tenth parts of any thing, and if a point and (0) cypher, or a digit be prefixed, it will be then ſo many hundred parts; and if a Point and two Cyphers or digits be prefixed, its Value is decreaſed to be ſo many thouſand parts; as if you would prefix before the Figure 3 a point (.) or prick thus (.3) it is then decreaſed from 3 Units or Integers, to (3) three tenth parts of an Unit or Integer; and if you prefix a point and Cypher thus (.03) it is decreaſed from 3 Integers to 3 hundred parts of an Integer, and by this means 5 *l.* Abſolute by prefixing of a point will be decreaſed to 5 *l.* Negative which is five tenth parts of a Pound, equal in value to ten ſhillings, and ſo by prefixing of more Cyphers or Digits, its value is decreaſed in a decuple proportion *ad infinitum.* As in the following Scheme, or rather order of numbers, we have placed (0) Cypher in its due place and order, as it is both the beginning and medium of number; for going from (0) towards the left hand you deal with Intire, Abſolute, Whole increaſing numbers.

Increaſing Numbers. | *Decreaſing Numbers.*

29	876	543	256	2 1 0 1 2	345	678	976	3
mm	mmmm	mmmm	mmmm	CXUXC	mmmm	mmmm	mmmm	m
mm	mmmm	mmmm	CX		XC	mmmm	mmmm	m
mm	mmmm	CX				XC	mmmm	m
mm	CX						XC	
X								

But going from (0) the place of Units towards the right hand, you meet with broken *Negative*, Fractional and decreaſing *Numbers.* And hence it follows that

Multiplication encreaſeth product in Abſolute Nu bers, but decreaſeth the product in Negative Numbe Alſo Diviſion decreaſeth the Quotient in whole Nu bers, and increaſeth it in Negative or Fractior Numbers.

14. An Abſolute, Intire, Whole, Increaſing *nu ber*, hath always a point annexed towards the rig hand and therefore.

15. A Negative, Broken, Decimal, Decreaſing *nu ber*, hath always a point prefixed before it towards t left hand. When we expreſs Integers or whc *numbers*, as 5 *pounds*, 5 *feet*, 26 *men*, we uſually annex

l. feet men 10

point or prick after the number thus, 5. 5. 26. 34 But when we expreſs Decimals, or Numbers that a denyed to be intire, as decreaſing *Numbers*, we do com monly prefix a point or prick before the ſaid Decim or decreaſing *number*, thus(.3) that is 3 tenths, or primes. 03, that is 3 hundredths, or 3 ſeconds.

16. A whole or abſolute *number* is an Unit or a com poſed Multitude of Units, and it is either a prim or elſe a compounded *number*.

17. Prime *numbers* amongſt themſelves are tho which have no multitude of Units for a common me ſurer as 8 and 7 or 10 and 13, becauſe not any mult tude of Units can equally meaſure or divide ther without a Remainder.

18. Compound *numbers* amongſt themſelves ar thoſe which have a multitude of Units for a commo meaſurer, as 9 and 12, becauſe 3 meaſures them ex actly, and abbreviates them to 3 and.

19 A Broken *number* commonly called a Fraction, a part or parts of a whole *number*, *viz.* a part of a Integer, as $\frac{1}{3}$ one third is one third part of an Unit

20. A Broken *number* or Fraction, conſiſts of 2 part *viz.* the Numerator and the Denominator.

21. The Numerator and Denominator of a Fraction are ſet one over the other, with a line between them and the Numerator is ſet above the line, and expreſſet the parts therein contained.

22. Th

22. The Denominator of a Fraction is the Inferior *number* placed below the line, and expreſſeth the number of parts into which the Unit or Integer is divided ; as let $\frac{3}{4}$ be the Fraction given, ſo ſhall 3 be the numerator, and doth expreſs or *number* the multitude of parts contained in this Fraction, for $\frac{3}{4}$ is a Fraction compoſed of Fourths or Quarters ; and the Figure 3 in *numbring* ſhews us that in that Fraction there are 3 of thoſe fourth parts or quarters ; alſo in the ſame Fraction $\frac{3}{4}$ 4 is the *denominator* and doth expreſs the Quality of the Fraction, *viz.* that the whole, or integer, is here divided into 4 equal parts.

23. A broken *number* is either Proper or Improper; *viz.* Proper; when the *numerator* is leſſer than the *denominator* ; ſo $\frac{3}{4}$ is a perfect proper Fraction, but an improper Fraction hath its *numerator* greater or at leaſt equal to the *denominator* ; thus $\frac{13}{8}$ is an improper Fraction, the Reaſon is given in the definition.

24. A proper broken *number* is either *Simple* or *Compound*, *viz. Simple*, when it hath one *Denomination*, and *Compound* when it conſiſteth of diverſe *Denominations*. If $\frac{3}{4}$ *l.* $\frac{5}{12}$, $\frac{25}{100}$ *l.* were given, we ſay they are either of them ſingle or *ſimple* Fractions becauſe they conſiſt but of one *numerator* and one *denominator* ; but if $\frac{3}{4}$ of $\frac{9}{12}$ of $\frac{25}{100}$ of a pound ſterling were given, we ſay that it is a *compound broken number*, or *fraction*, becauſe the expreſſion and repreſentation conſiſteth of more *denominations* than one; and ſuch by ſome are called *Fractions of Fractions*, and they have always this Particle (of) between them.

25. When a ſingle *broken number* or *Fraction*, hath for his *denominator* a *number* conſiſting of a Unit in the firſt place towards the left hand, and nothing but Cyphers from the Unit towards the right hand, it is then the more aptly and rightly called a decimal Fraction ; under this head are all our decreaſing *numbers* placed, and in our 13th. *definition* called Negative, and by that order there preſcribed, we order them to be *Decimals* by ſigning a point or prick before them, or the *numerator* rejecting the *denominator* : Therefore ac-

cording to our laſt Rule, [illegible] $\frac{5}{100}$ $\frac{25}{100}$ $\frac{25}{1000}$ are ſa to be *Decimals* ; and a *Decimal Fraction* may be expr ſed without its *denominator* (as before) by prefixing point or prick before the *numerator* of the ſaid *Fracti* and then ſhall the former *Fraction* $\frac{5}{10}$ and $\frac{25}{100}$ ſta thus .5 and .25.

But oftentimes as in the ſecond and fourth fractio $\frac{5}{100}$ and $\frac{25}{1000}$, a prick or point will not do witho the help of a Cypher or Cyphers prefixed before th ſignificant figures of the *numerator*, and therefore whe the *numerator* of a *decimal fraction*, conſiſteth not ſo many places as the *Denominator*, hath Cyphers, fi up the void places of the *numerator*, with prefixing C phers before the ſignificant figures of the *num rator*, and then ſign it for a *decimal*, ſo ſhall $\frac{5}{100}$ be .0 and $\frac{25}{1000}$ will be .025 and $\frac{72}{10000}$ will be .0072. No by this we may eaſily diſcover the *denominator* havin the *numerator* ; for always the denominator of an *decimal fraction* conſiſts of ſo many Cyphers, as th *numerator* hath places, with a Unit prefixed before th ſaid Cyphers, *viz.* under the point or prick.

26. A *Decimal Number* or *Fraction*, is that which expreſſed by *Primes*, *Seconds*, *Thirds*, *Fourths*, &c. an is number decreaſing. Here inſtead of *Natural* an *Common Fr actions*, as $\frac{3}{4}$ of a thing, we order the thin or Integer into *Primes*, *Seconds*, *Thirds*, *Fourths*, *Fifth* &c. that our expreſſion may be conſonant to ou former order.

27. In *Decimal Arithmetick*, we always imagin (an it would be very commodious if it were really ſo that all intire Units, Integers, and things are divide firſt into ten equal parts, and theſe parts ſo divided w call *Primes* ; and ſecondly, we divide alſo each of th former *Primes* into other ten equal parts, and every o theſe diviſions we call ſeconds ; and thirdly, we divid each of the ſaid Seconds into ten other equal part and thoſe ſo divided we call *Thirds* and ſo by decima ting the former and ſub-decimating theſe latter, w run on *ad infinitum.*

28. Let a pound ſterling, Troy weight, Averdu

pois weight, Liquid Meaſure, Dry meaſure, Long meaſure, time, dozen or any other thing, or Integer be given to be *decimally* divided ; in this notion premiſed we ought to let the firſt Diviſion be *Primes*, the next diviſion *Seconds*, the next *Thirds*, &c. So one pound Sterling being 20 ſhillings, which divided into ten equal parts, the value of each part will be two ſhillings ; therefore one *Prime* of a pound Sterling will ſtand thus (.1) which is in value 2 ſhillings, Three *Primes* will ſtand thus (.3) and that is in value 6 ſhillings. Again a *Prime* or .1 being divided into ten equal parts, each of thoſe parts will be one *Second*, and is thus expreſſed, (.01) and its Value will be found to be 2d. farthing and $\frac{6}{10}$ of a farthing ; and ſo will. 05 ſignifie one ſhilling, or five *Seconds*. And if .01 be divided into ten other equal Parts, each of thoſe parts ſo divided will be *Thirds*, and will ſtand thus .001, and its Value will be found to be 96 of a Farthing, or $\frac{96}{100}$ of a Farthing ; and .009 *Thirds* will be 2d. and .64 of a Farthing, or $\frac{64}{100}$ of a Farthing, *&c.* So that .375 *l.* will be found to repreſent 7s. and 6d. ; for the 3 *Primes* are 6 ſhillings, and the 7 *Seconds* are 1s. 4d. and $\frac{8}{10}$ of a penny, and the five *Thirds* are 1 penny and $\frac{2}{10}$ of a penny, both which added together make 7*s.* 6*d.*

29. If you put any bulk or body, repreſenting an Integer if it be *decimally divided* ; then the parts in the firſt decimation are *Primes*, the next *Seconds*, and the next decimation is *Thirds*, the next *Fourths*, &c. As let there be given a Bullet of Lead, or ſuch like, whoſe weight let be 50 *l. Troy*, this call an Unit, Integer, or thing, then with the like weight and matter, make 10 other, the which together will be equal to 50 *l.* and will weigh each of them 5 *l.* a piece, take of the ſame matter, and equal to 5 *l.* make 10 more, then each of thoſe will weigh 6 ounces a piece ; alſo if again you take 6 ounces and thereof make 10 other ſmall bullets each of them will weigh 12 penny weight *Troy* ; and thus have you made *Primes*, *Seconds*, and *Thirds*, in reſpect of the Integer containing 50 *l. Troy* ; and that 5 *Primes* is equal to the half maſs, and 2 *Primes* and 5 *Seconds* is a quarter of the maſs ; and therefore it

of the firſt diviſion, 2 of the ſecond diviſion, and of the third diviſion, will be equal in weight to $\frac{1}{2}$ quarter of the maſs, and contain 6 l. and 3 ounces.

30. When a *decimal Fraction* followeth a whol *number*, you are to ſeparate or part the *decimal* from th *whole number*, by a point or prick ; ſo if .7 followed the *whole number* 32, ſet them thus 32. 7 You ſhall find that divers Authors have divers ways in expeſſing mixt *numbers*, as thus, 32|75 or 32 $\frac{75}{100}$ c 32.$\ddot{75}$ but you will find that 32.75 thus placed and ex preſſed is fitteſt for Calculation.

31. A mixt *number* hath 2 parts, the whole and th broken ; the whole is that which is compoſed of Inte gers, and the broken is a Fraction annexed thereunt So the mixt *number* 36$\frac{8}{12}$ being given, we ſay that 3 is the whole *Number*, which is compoſed of Integers, an the $\frac{8}{12}$ is the broken *Number* annexed, which ſhewet that one of the former Integers (of that 36) being d vided into 12 parts, this $\frac{8}{12}$ doth expreſs 8 of tho 12 parts more belonging to the ſaid 36 Integers.

32. *Denominative bnumers* are of one, or of man and thoſe are of divers ſorts and kinds, *viz. Singul* called Unit, as 1 ; and *Plural* called multitude ; as 2, 4, 5, *Single* of one kind only, called *digits*, as 1, 2, 4, 5, 6, 7, 8, 9, and *Compounds* of many, 10, 11, 1 *&c.* 102, 367, *&c.*

Proportional, as Single, Multiple, Double, Tripl Quadruple, *&c.* Denominate as Pounds, Shilling Pence ; Undenominate as 1, 2, 3, *&c.* Perfect is 28, 496, 8128, 130816, 2096128, *&c.* Whoſe par are equal to the numbers ; imperfect, unequal and mor than the ſum, as 12 to 1, 2, 3, 4, 6. Imperfect, unequ and leſs than the ſum, as 8 to 1, 2, 4. Numbers Com menſurable and Incommenſurable, as 12 and 9 a Commenſurable becauſe three meaſures them both.

But 6 and 17 are Incommenſurable becauſe no o common *number* or *meaſure* can meaſure them ; Line in form of a line, as ... . Superficial in form of Superficies or plane, as :::: ::: or ⁞⁞ ⁞⁞, *&c.* an

numb

number cubical or ſolid, in form of a Cube. Theſe two latter are otherwiſe called figurative numbers: There are alſo other numbers called Tabular, as Signs, Tangents, Secants, *&c.* Other that be called Logarithmetick or borrowed numbers, fitted to proportion for eaſe and ſpeedy Calculation of all manner of Queſtions.

CHAP. II.

Of the Natural Diviſion of Integers, and the ſeveral Denominations of the Parts.

1. BEfore we come to Calculation or the ordering of *Numbers* to operate any Arithmetical Queſtion propoſed, we will lay down Tables of the Denomination of ſeveral Integers; and after that (having mentioned the ſeveral Species or kinds of Arithmetick) we ſhall immediately handle the Species of Numeration, which are the main Pillars upon which the whole Fabrick of this Art is built.

Of Money, Weights, &c.

2. The leaſt Denomination or Fraction of Money uſed in *England* is a Farthing, from whence is produced the followed Tables, called the Table of Coyne, (*viz.*)

1 *Farth.*	make	1 *Farthing*
4 *Farth.*		1 *Penny*
12 *Pence*		1 *Shilling*
20 *Shill.*		1 *Pound*

And therefore,

l.	s.	d.	qrs.
1	20	12	4
1	20	240	960
	1	12	48
		1	4

The firſt of theſe Tables, *viz.* that on the left hand is plain and eaſie to be underſtood, and therefore needs no directions. In the ſecond Table above the line yo have 1 *l.* 20 *s.* 12 *d.* 4 *qrs.* whereby is meant tha 1 pound is equal to 20 ſhillings, and one ſhilling equal to 12 pence, and one penny is equal to 4 Far things, under the line is 1 *l.* 20 *s.* 240 *d.* 960 *gr* which ſignifies one pound to contain 20 ſhillings, c 240 pence, or 960 Farthings ; in the ſecond line be low that is 1*s.* 12 *d.* 48 *qrs.* the firſt ſtanding unde the Denomination of Shillings, whereby is to be note that one ſhilling is equal to 12 pence, or 48 Farthing and likewiſe that below that, one penny is equal i value to four Farthings ; underſtand the like reaſo in all the following Tables of Weight, Meaſure, Tim Motion and Dozen.

Of Troy Weight.

3. The leaſt Fraction or Denomination of weigh uſed in *England*, is a grain of Wheat gathered out o the middle of the Ear, and well dryed ; from whenc are produced theſe following Tables of Weight, calle *Troy weight.*

32 *Grains of Wheat*	make	24 *Artificial grains*
24 *Artificial Grains*		1 *Penny weight*
20 *Penny weight*		1 *Ounce*
12 *Ounces*		1 *Pound Troy weight*

And therefore

l.	*oun.*	*p.w.*	*grains.*
1	15	43	24
1	12	240	5760
	1	20	480
			24

Troy weight ſerveth only to weigh bread, gold, ſilve and Electuaries ; it alſo regulateth and preſcribeth [illegible] how to keep the Mony of *England* at a certa ſtand ſtandard. The Goldſmiths have divided the Ounce *Troy weight* into other parts, which they generally call Mark weight; the denominative parts thereof are as followeth, *viz*, A Mark (being an ounce Troy) is divided into 24 equal parts, called Carects and each Carect into grains, ſo that in a Mark are 96 Grains; by this weight they diſtinguiſh the different fineneſs of their Gold, for if to the fineneſs of Gold be put 2 Carects of Alloy (which is of Silver, Copper, or other baſer Metal, with which they uſe to mix their Gold or ſilver to abate the fineneſs thereof) both making, when cold but an ounce, or 24 Carects, then this Gold is ſaid to be 22 Carects fine, for if it come to be refined the 2 Carects of Alloy will fly away and leave only 22 Carects of pure Gold, the like to be conſidered of a greater or leſſer quantity; and as the fineneſs of Gold is eſtimated by Carects, ſo the fineneſs of Silver is diſtinguiſhed by ounces; for if a pound of it be pure, and looſeth nothing in the Refining, ſuch ſilver is ſaid to be twelve ounces fine, but if it loſeth any thing, it is ſaid to contain ſo much fineneſs as the loſs wanteth of 12 ounces, as if it loſe an ounce it is ſaid to be 11 Ounces fine, and if it loſe one ounce 14 penny weight, then it is ſaid to be 10 ounces 6 penny weight fine, and that which loſeth 2 ounces 4 penny weight 16 grains is ſaid to be 9 ounces 15 penny weight 8 grains fine, *&c.* the like of a greater or leſſer quantity.

Of Apothecaries Weights.

4. The *Apothecaries* have their Weights deduced from Troy Weight, a pound *Troy*, being the greateſt Integer, a Table of whoſe diviſion and ſub-diviſion followeth, *viz.*

1 *pound*	makes	12 *ounces*
1 *ounce*	makes	8 *drams*
1 *dram*	makes	3 *ſcruples*
1 *ſcrup.*	makes	20 *grains*

And therefore

l.	*oun.*	*dram.*	*ſcrup.*	*gr.*
1	12	8	3	20
1	12	96	288	5760
	1	8	24	480
		1	3	60
			1	20

5. Thus much concerning *Troy weight*, and its d rivavite weights (which as was ſaid before) ſerve to weigh Bread, Gold, Silver, and Electuaries; no beſides *Troy-weight* there is another kind of weig uſed in *England*, commonly known by the name *Auerdupois* weight (a pound of which is equal to 1 ounces 12 penny weight *Troy weight*) and it ſerveth weigh all kinds of Grocery-Wares, as alſo Butte Cheeſe, Fleſh, Wax, Tallow, Rozen, Pitch, Lea and all ſuch kind of Garbel, the Table of whic weight is as followeth.

The Table of Averdupois Weight.

4 *quarters of a dram*	*make*	1 *dram*
16 *drams*		1 *ounce*
16 *ounces*		1 *pound*
28 *pounds*		1 *quarter of a hundred*
4 *quarters*		1 *hundred-weight, or* 112
20 *hundred*		1 *Tun*

And therefore,

Tun	*C.*	*qrs.*	*l.*	*oun.*	*dra.*	*qrs*
1	20	4	28	16	16	4
1	20	80	2240	35840	573440	2293760
	1	4	112	1792	28672	114688
		1	28	448	7168	28672
			1	16	256	1024
				1	16	64
					1	4

Wool is weighed with this Weight, but only the Diviſions are not the ſame; A Table whereof followeth.

A Table of the denominative Parts of Wool Weight.

7 *Pounds*	*make*	1 *Clove*
2 *Cloves*		1 *Stone*
2 *Stones*		1 *Todd*
6 *Todd* 1 *Stone*		1 *Wey*
2 *Weyes*		1 *Sack*
12 *Sacks*		1 *Last*

And therefore

Laſt	*Sacks*	*Wey*	*Todd*	*Stone*	*Cloves*	*l.*
1	12	2	6½	2	2	7
1	12	24	156	312	624	4368
	1	2	13	26	52	364
		1	6½	13	26	128
			1	2	4	28
				1	2	14
					1	7

Note that in ſome Countrys the *Wey* is 256 *l. Averdupois.* as is the *Suffolk Wey*; but in *Eſſex* there is 336 pound in a *Wey.*

6. The leaſt Denominative part of Liquid meaſure is a pint, which was formerly taken from *Troy Weight,* (a pound of Wheat *Troy Weight* making 1 pint of liquid meaſure) but in regard of the difference between the Brewers and the Farmers of his Majeſty's Exciſe concerning the gauging of Veſſels occaſioned by the different Opinions of Artiſts, concerning the ſolid Inches in a Gallon; it was lately decided by Act of Parliament, the Statute making 282 ſolid Inches in a Beer-Gallon, and 231 in a Wine-meaſure and conſequently the Pint Beer-Meaſure to contain 35¼ ſolid Inches, and the Pint Wine-meaſure to contain 28⅞ cubical or ſolid Inches, from whence is drawn the following Table.

The Table of Liquid Meaſure.

25¼ *cubical Inch*	make	1 *pint beer meaſure*
28⅞ *cubical Inch*		1 *pint wine meaſure*
2 *pints*		1 *quart*
2 *quarts*		1 *pottle*
2 *pottles*		1 *gallon*
8 *gallons*		1 *firk. of ale, ſoap, or herr.*
9 *gallons*		1 *firk. of beer*
10 *gal. and a half*		1 *firk. of Salmon or Eels*
2 *firkins*		1 *Kilderkin*
2 *kilderkins*		1 *barrel*
42 *gallons*		1 *Tierce of wine*
63 *gallons*		1 *hogſhead*
2 *hogſheads*		1 *pipe or butt*
2 *pipes or butts*		1 *Tun of wine*

And therefore,

Tuns	*pipes*	*hhds*	*gal.*	*pts.*
1	2	2	63	8
1	2	4	252	2016
	1	2	126	1008
		1	63	504
			1	8
				1

7. The leaſt Denominative part of dry meaſure alſo a pint, and this is likewiſe taken from *Troy weigh* The Table of whoſe diviſion followeth.

The Table of Dry Meaſure.

1 *pint*	make	1 *pint*
2 *pints*		1 *quart*
2 *quarts*		1 *pottle*
2 *pottles*		1 *gallon*
2 *gallons*		1 *peck*
4 *pecks*		1 *buſhel*
4 *buſhels*		1 *Comb*
2 *Combs*		1 *quarter*
4 *quarters*		1 *Chaldron*
5 *quarters*		1 *Wey*
2 *Weys*		1 *Laſt*

And therefore,

laſt	*wey*	*qrs.*	*com.*	*buſh.*	*peck*	*gall.*	*pints*
1	2	5	2	4	4	2	8
1	2	10	20	80	320	640	5120
	1	2	10	40	160	320	2560
		1	5	8	32	64	512
			1	4	16	32	256
				1	4	8	64
					1	2	16
						1	8

8. The leaſt Denominative part of *Long Meaſure* is a Barly-Corn well dryed and taken out of the middle of the Ear ; whoſe Table of parts followeth.

The Table of Long Meaſure.

3 *barly-corns*	make	1 *inch*
12 *inches*		1 *foot*
3 *Feet*		1 *yard*
3 *feet* 9 *inches* *or yard and quart.*		1 *Ell Engliſh*
6 *feet*		1 *fathom*
5 *yards and a half*		1 *pole or perch*
40 *poles or perches*		1 *furlong*
8 *furlongs*		1 *Engliſh mile.*

And therefore,

mile	*furl.*	*poles*	*yards*	*feet*	*inches*	*barl.corns*
1	8	40	5½	3	12	3
1	8	320	1760	5280	63360	190080
	1	40	220	660	7920	23760
		1	5½	16½	198	594
			1	3	36	108
				1	12	36
					1	3

And note that the yard as alſo the ell, is uſually divided into 4 quarters, and each quarter into 4 Nails.

Note alſo that a Geometrical Pace is 5 feet ; and there are 1056 ſuch Paces in an *Engliſh* mile.

2. The parts of the Superficial meaſures of land are ſuch as are mentioned in the following Table, *viz.*

The Table of Land Meaſure.

40 *Square Poles or Perches*	make	1 *Rood or quarter of an Acre.*
4 *Roods*		1 *Acre.*

By the foregoing Table of long Meaſure, you informed what a pole, or (which is all one) perch and by this that 40 ſquare perches are 1 Rood. N by a ſquare perch is a Superficies very aptly reſemb by a ſquare Trencher, every ſide thereof being a per or 5 Yards and a half in length, 40 of them is a R and 4 Roods an Acre. So that a Superficies that is perches long and 4 broad is an Acre of Land, the A containing in all 160 ſquare Perches.

10. The leaſt denominative part of Time is a M nute, the greateſt Integer being a Year; from whe is produced this following Table.

The Table of Time.

1 *Minute*	make	1 *Minute*
60 *Minutes*		1 *Hour*
24 *Hours*		1 *Day natural*
7 *days*		1 *Week*
4 *Weeks*		1 *Month*
13 *Months* 1 *day & 6 hours*		1 *Year*

But the Year is uſually divided into 12 unequal lendar Months, whoſe names and the number of D that they contain follow, *viz.*

	days
January	31
February	28
March	31
April	30
May	31
June	30
July	31
Auguſt	31
September	30
October	31
November	30
December	31

So that the Year containeth 3 Days, and 6 Hours, but the 6 Ho is not reckoned but only every 4 year, and then there is a day adde the latter end of *February*, and the containeth 29 days, and that yea called Leap-year, and containeth 3 days.

A

And here note that as the Hour is divided into 60 Minutes, ſo each Minute is ſubdivided into 60 *Seconds*, and each *Second* into 60 *Thirds*, and each *Third* into 60 *Fourths*, &c.

The Tropical Year by the exacteſt obſervations of the moſt accurate Aſtronomers is found to be 365 Days, 5 Hours, 49 Minutes, 4 *Seconds*; and 21 *Thirds*.

CHAP. III.

Of the Species or Kinds of Arithmetick.

1. ARithmetick is either Natural, Artificial, Analytical, Algebraical, Lineal or Inſtrumental.

2. Natural Arithmetick is that which is performed by the Numbers themſelves; and this is either Poſitive or Negative. Poſitive which is wrought by certain infallible numbers propounded, and this either Single or Comparative; Single which conſidereth the nature of *numbers* ſimply by themſelves; and Comparative, which is wrought by *numbers* as they have Relation one to another. And the Negative part relates to the Rule of *Falſe*.

3. Artificial (by ſome called Logarithmetical) Arithmetick is that which is performed by Artificial or borrowed *numbers* invented for that purpoſe, and are called Logarithms.

4. Analytical Arithmetick, is that which ſhews from a thing unknown to find truly that which is ſought; always keeping the Species without Change.

5. Algebraical Arithmetick, is an obſcure and hidden Art of Accompting by numbers in reſolving of hard Queſtions.

6. Lineal Arithmetick, is that which is performed by fitted lines to porportions, as Geometrical projections.

7. Inſtrumental Arithmetick, is that which is performed by Inſtruments fitted with Circular and Right lines of Proportion, by the Motion of an Index or otherwiſe.

8. The parts of Single Arithmetick are Numerati and the Extraction of Roots.

9. Numeration is that by which certain kno numbers propounded, we diſcover another numb unknown.

10. Numeration hath four Species; *viz.* Additi Subſtraction, Multiplication, and Diviſion.

CHAP. IV.

Of Addition of whole Numbers.

1. ADdition is the Reduction of two or more *nu bers* of like kind together into one Sum Total. Or it is that by which divers *numbers* are addi together, to the end that the Sum or Total value them all may be diſcovered.

The firſt *number* in every addition is called the Add ble *number*, the other, the *number* or *numbers* added, a the *number* invented by the Addition is called the *A gregate* or *Sum* containing the value of the *Addition.*

The Collation of the *numbers*, is the right placing the *numbers* given reſpectively to each denominatic and the Operation is the Artificial adding of t *numbers* given together in order to the finding out the *Aggregate* or *Sum.*

2. In Addition, place the *Numbers* given reſpective the one above the other, in ſuch ſort, that the li degree, place or denomination, may ſtand in the ſa Series, *viz.* Units under Units, Tens under Tens, Hu dreds under Hundreds, *&c.* Pounds under Poun Shillings under Shillings, Pence under Pence, & Yards under Yards, Feet under Feet, *&c.*

3. Having thus placed the *numbers* given (as befo and drawn a line under them, add them together, b ginning with the leſſer Denomination, *viz.* at the rig hand and ſo on, ſubſcribing the ſum under the li Reſpectively; as for Example.

Let there be given 3352 and 213 and 133 to be dded together, I ſet the Units in each particular *umber* under each other, and ſo likewiſe the Tens nder the Tens, &c. and draw a line under hem as in the Margent, then I begin at the lace of Units and add them together up- ards, ſaying, 3 and 3 are 6 and 2 make 8 hich I ſet under the line, and under the ame Figures added together; then I pro- eed to the next place, being the place of ens, and add them up in the ſame manner as I did he place of Units, ſaying 3 and 1 are 4 and 5 are 9, hich I likewiſe ſet under the line reſpectively; then go to the place of Hundreds, and add them up as I id the other, ſaying 1 and 2 are 3 and 3 are 6, which alſo ſet under the line; and laſtly I go to the place of houſands, and becauſe there are no other figures to dd to the 3, I ſet it under the line in its reſpective lace, and ſo the work is finiſhed; and I find the ſum f the 3 given Numbers to be 3698.

3352
213
133
———
3698

4. But if the Sum of the Figures of any Series ex- ceeds ten, or any *number* of tens, ſubſcribe under the ame the Exceſs above the tens, and for every ten arry one to be added to the next Series towards the eft hand, and ſo go on until you have finiſhed your ad- ition; always remembring, that how great ſoever the um of the Figures of the laſt Series is, it muſt all be t down under the line reſpectively. So 3678 being iven to be added to 2357, I ſet them down as is be- ore directed, and as you ſee in the Margent with a ine drawn under them, then I begin and dd them together, ſaying 7 and 8 are 15, which is 5 above 10, wherefore I ſet 5 under he line and carry 1 for the 10 to be added o the next Series, ſaying 1 that I carried and 5 is 6 and 7 are 13, wherefore I ſet down 3 and carry 1 (for the ten) to the next Series, then ſay 1 that I carried and 3 are 4 and 6 are 10, now ecauſe it comes to juſt 10 and no more, I ſet 0 under he line and carry 1 for the 10 to the next, and ſay, 1

3678
2357
———
6035

that I carried and 2 are 3 and 3 are 6, which I ſe down in its Reſpective place, thus the addition is en ded, and the total Sum of theſe *numbers* is found t be 6035, ſeveral Examples of this kind follow.

Numbers to be added
354867
573846
785946
347205
Sum 2061864

Numbers to be added
748647
465834
76483
648300
Sum 1939264

Numbers to be added
45346
38074
8437
923
76
Sum 92856

5. If the Numbers given to be added, are contained under divers denominations; as of Pounds, Shillings, Pence and Farthings; or of Tuns, Hundreds Quarters, Pounds, *&c.* Then in this caſe having diſpoſed of the *Numbers*, each Denomination under other of like kind; beginning at the leaſt Denomination, (minding how many of one denomination do make an Integer of the next) and having added them up, for every Integer of the next greater denomination that you find therein contained, bear an Unit in mind to be added to the ſaid next greater denomination, expreſſing the exceſs reſpectively under the line, proceed in this manner until your addition be finiſhed; the following Examples will make the Rule plain to the Learner. Thus theſe ſeveral ſums being given to be added *viz.* 136 *l.* 13 *s.* 4 *d.* 2. *qrs.* and 79 *l.* 07 *s.* 10 *d.* 3 *qrs*, and 33 *l.* 18 *s.* 09 *d.* 1 *qr.* alſo 15 *l.* 09 *s.* 07 *d.* 00 *qrs.* The *Numbers* being diſpoſed according to order will ſtand as in the Margent. Then I begin at the denomination of Farthings

and

l.	*s.*	*d.*	*qrs*
136	13	04	2
79	07	10	3
33	18	09	1
15	09	05	0
265	09	04	2

d add them up; ſaying 1 and are 4 and 2 make 6; now I nſider that 6 Farthings is 1 nny, and 2 Farthings, where re I ſet down the 2 Farthings its place under the line, and ep 1 in mind to be added to e next denomination of Pence; n I go on, ſaying 1 that I carr d and 5 are 6 and 9 are 15 and 10 are 25 and 4 are ; now I conſider that 29 pence are 2 ſhillings and pence, whereof I ſet the 5 pence in order under e line and keep 2 in mind for the 2 ſhillings, to be ded to the ſhillings; then I go on, ſaying, that 2 I rried and 9 are 11; and 18 are 29, and 7 are 36, d 13 are 49; then I conſider that 49 ſhillings are pounds and 9 ſhillings, wherefore I ſet the 9 ſhillings der the line, and carry two for the 2 pounds, to the t and laſt denomination of pounds, and proceed, ing 2 that I carried and 5 make 7, and 3 are 10, d 9 are 16, and 9 are 25; then I ſet down 5 and rry 2 for the tens, and proceed, ſaying, 2 that I rry and 1 is 3, and 3 are 6, and 7 are 13, and 3 ake 16; I ſet down 6 and carry 1 for the 10, and on, ſaying 1 that I carried and 1 are 2, which I ſet its place under the line, and the work is finiſhed; d thus I find the Sum of the foreſaid *Numbers* to be 5 *l.* 9 *s.* 5 *d.* 2 *qrs.* This to the ingenious Practi oner is ſufficient, but I ſhall (for the further illumi ting of weaker apprehenſions) explain the opera on of another Example in *Troy weight*; and here the arner muſt take notice of the Table of *Troy weight* entioned or ſet down in the third Section of the ſe nd Chapter. The *numbers* given in this Example 38 *l.* 7. *oz.* 13. *p.w.* 18 *gr.* And 50 *l.* 10 *oz.* 10 *p.w.* *gr.* And 42 *l.* 08 *oz.* 05 *p.w.* 16 *gr.* And in der to the Addition thereof, I place them as you , and proceed to operation; ſaying, 16 and 12 are , and 18 are 46; now becauſe 24 *grains* make

1 *penny*

l.	oz.	p.w.	g
38	07	13	18
59	10	10	1
42	08	05	16
132	02	09	2

1 *penny weight*, 46 *grains* are 1 *penny weight* and 22 *grains*; wherefore I ſet down 22, and carry 1 for the *penny weight*, and going on I ſay 1 that carry and 5 make 6, and 10 are 16, and 13 are 29, which is one ounce and 9 *penny weight*, I ſet down 9 in its place under the lin and carry 1 to the ounces, ſaying 1 that I carry and are 9, and 10 are 19, and 7 are 26, and becauſe 2 *ounces* make 2 *pound* 2 *ounces*, I ſet down 2 for the *ounces*, and carry 2 to the *pounds*: going on, 2 that I carr and 2 are 4, and 8 make 12, that is 2 and go 1; ther 1 I carry and 4 are 5 and 5 are 10, and 3 are 13, whic I ſet down as in the Margent, and the work is finiſhe and I find the ſum of the ſaid *numbers* to amount to 132 2 *oz.* 1 *p.w.* 22 *gr.* This is ſufficient for the underſtanding of the following Examples, or any other tha ſhall come to thy View. The Way of proving the or any Sums in this Rule is ſhewed immediately afte the enſuing Examples.

Addition of English Money.

l.	s.	d.	qrs.
436	12	07	1
184	00	10	3
768	17	04	2
564	11	11	0
1954	12	09	2

l.	s.	d.	qrs.
48	15	11	1
76	10	07	3
18	00	05	3
24	19	09	2
168	06	10	1

Addition of Troy Weight.

l.	oz.	p.w.	gr.
15	07	13	12
18	06	04	20
11	10	16	18
09	04	10	22
19	11	11	04
22	00	00	00
97	05	04	04

l.	oun.	p.w.	gr.
145	09	12	18
726	08	14	10
380	07	06	13
83	10	16	20
130	00	10	12
74	07	15	00
1541	08	16	00

Additi

Addition of Apothecaries Weights.

l.	*oun.*	*dr.*	*ſcr.*	*gr.*
48	07	1	0	14
74	05	5	2	10
64	10	7	1	16
17	08	1	0	11
34	09	6	1	09
240	05	6	1	00

l.	*oun.*	*dr.*	*ſcr.*	*gr.*
60	03	4	0	10
48	10	6	0	14
34	08	2	1	15
18	11	2	2	11
160	07	1	2	15
35	02	5	1	07
358	07	7	0	12

Addition of Averdupois Weight.

un	*C.*	*qrs.*	*l.*
75	13	1	15
48	07	3	21
50	11	1	17
21	07	0	25
2	16	0	11
18	16	0	05

l.	*oun.*	*dr.*
36	10	12
22	11	13
11	07	04
15	04	10
20	00	09
106	03	00

Addition of Liquid Meaſure.

un	*Pipe*	*hhd.*	*gall.*
45	1	1	48
15	0	1	17
38	0	0	47
12	1	0	56
21	1	1	18
33	1	1	60

Tuns	*hhds.*	*gall.*	*pts.*
39	3	40	4
12	0	28	6
47	5	60	5
57	3	22	3
17	0	00	0
166	1	26	2

Addition of Dry Meaſure.

Chald.	*qrs.*	*buſh.*	*pec.*	*qrs.*	*buſh.*	*pec.*	*gal.*
48	3	7	3	17	3	1	1
13	1	4	0	50	1	3	
54	0	6	2	14	5	3	1
16	3	6	1	40	2	0	
40	1	0	1	30	0	3	
173	3	0	3	152	5	3	11

Addition of Long Meaſure.

yds.	*qrs.*	*na*	*ells.*	*qrs.*	*na*
35	3	3	56	1	
14	1	2	13	3	
74	2	3	48	2	
38	0	1	50	1	
30	1	0	74	0	
15	0	0	17	1	
218	1	1	260	2	

Addition of Land Meaſure.

Acre	*Rood*	*perc*	*Acre*	*Rood*	*per*
12	3	18	86	1	3
14	0	24	47	3	2
30	2	19	73	2	1
48	3	30	60	0	0
28	1	38	04	2	0
50	3	26	14	1	1
185	3	35	286	3	2

Th

The Proof of Addition.

6. *Addition* is proved after this manner, when you ave found out the ſum of the Numbers given, then parate the uppermoſt line from the reſt, with a ſtroke daſh of the pen, and then add them all up again as u did before, leaving out the uppermoſt line, and ving ſo done add this new invented ſum to the uprmoſt line you ſeparated, and if the ſum of thoſe lines be equal to the ſum firſt found out, then the ork was performed true, otherwiſe not: As for Exnple, let us prove the firſt Example of *Addition* of oney whoſe ſum we found to be 265 *l.* 9 *d.* 2 *qrs.* d which we prove thus, having parated the uppermoſt numr from the reſt, by a line as u ſee in the Margent, then I d the ſame together again, lea-g out the ſaid uppermoſt line, d the ſum thereof I ſet under e firſt ſum or true ſum, which th amount to 128 *l.* 16 *s.* 01 *d.* *qrs.* then again I add this new m to the uppermoſt line that fore was ſeparated from the t, and the ſum of theſe two 265 *l.* 09 *s.* 05 *d.* 2 *qrs.* the ne with the firſt Sum, and therefore I conclude at the Operation was rightly performed.

l.	*s.*	*d.*	*qrs.*
136	13	04	2
79	07	10	3
33	18	09	1
15	09	05	0
265	09	05	2
128	16	01	0
265	07	05	2

7. The main end of *Addition* in Queſtions Reſolvar thereby, is to know the ſum of ſeveral Debts, rcels, Integers, &c. Some Queſtions may be theſe ut follow.

Queſt. 1. There was an old Man whoſe age was reired, to which he replyed, I have ſeven Sons, each ving two years between the birth of each other, and the 44 year of my age my eldeſt Son was born, ich is now the age of my youngeſt; I demand at was the Old Mans age?

Now to reſolve this Queſtion, firſt ſet down the Fathers age at the birth of his firſt Child, which was 44, then the difference between the eldeſt and the youngeſt which is 12 years, and then the age of the youngeſt which is 44, and then add them all together, and their ſum is 100 the compleat Age of the Father.

44
12
44
10

Queſt. 2. A *Man* lent his Friend, at ſeveral time theſe ſeveral Sums, (*viz.*) at one time 63 *l.* at anc ther time 50 *l.* at another time 48 *l.* at another tim 156 *l.* now I deſire to know how much was lent hi in all.

Set the Sums lent one under another, as you ſee in the *Margent*, and then add them together, and you will find their Sum to amount to 317 *l.* which is the Total of all the ſeveral Sums lent, and ſo much is due to the Creditor.

63
50
48
156
317

Queſt. 3. From *London* to *Ware* is 20 miles, thence *Huntington* 29 miles, thence to *Stamford* 21 miles, then to *Tuxford* 36 miles, thence to *Wentbridge* 25 mile from thence to *York* 20 miles. Now I deſire know how many miles it is from *London* to *York* acco ding to this reckoning.

Now to anſwer to this Queſtion, ſet down the ſeveral diſtances given, as you ſee in the Margent, and add them together, and you will find their Sum to amount to 151, which is the true diſtance in miles between *London* and *York.*

20
29
21
36
25
20
151

Queſt. 4. There are two numbers, leaſt the wher of is 40, and their Difference is 14, I deſire to know what is the greater number, and alſo what is the Sum of them both? Firſt, ſet down the leaſt, *viz.* 40, and 14 the difference, and add them together, and their ſum is 54 for the greateſt number,

4
1
greateſt 5
leaſt 4
ſum 9

th

then I ſet (40 the leaſt) under 54 (the greateſt) and add them together, and their Sum is 94 equal to the greateſt and leaſt numbers.

CHAP. V.

Of Subſtraction of whole Numbers

1. S*Ubſtraction* is the taking of a leſſer number out of a greater of like kind, whereby to find out a third number, being or declaring the inequality, exceſs, or difference between the numbers given; or *Subſtraction* is that by which one number is taken out of another number given, to the end that the reſidue or remainder may be known, which remainder is alſo called the *Reſt*, *Remainder*, or *Difference* of the numbers given.

2. The number out of which *Subſtraction* is to be made, muſt be greater, or at leaſt equal with the other number given; the higher or ſuperiour number is called the major number, and the lower or inferiour is called the minor number, and the operation of *Subſtraction* being finiſhed, the Reſt or Remainder is called the difference of the Numbers given.

3. In *Subſtraction* place the Numbers given reſpectively, the one under the other, in ſuch ſort as like degrees, places, or denominations may ſtand in the ſame Series, *viz.* Units under Units, Tens under Tens, *&c.* Pounds under Pounds, *&c.* Feet under Feet, and Parts under Parts, *&c.* This being done, draw a line underneath, as in *Addition.*

4. Having placed the Numbers given as is before directed, and drawn a line under them, ſubſtract the lower number (which in this caſe muſt alwayes be leſſer than the uppermoſt) out of the higher number, and ſubſcribe the difference, or remainder reſpectively below the line; and when the Work is finiſhed, the

number below the line will give you the Remainder As for Example, let 364521 be given to be ſubſtracte from 795836, I ſet the leſſer under the greater as the Margent, and draw a line under them, then b ginning at the Right hand, I ſay 1 out of 6 and there remains 5, which I ſet in order under the line ; then I proceed to the next, ſaying 2 from 3 reſts 1, which I note alſo under the line, and thus I go on until I have finiſhed the Work, and then I find the Remainder or Difference be 431315.

795836
364521
———
431315

5. But if it ſo happen (as commonly it doth) th the lowermoſt number or figure is greater than t uppermoſt ; then in this caſe add ten to the upper moſt number, and ſubſtract the ſaid lowermoſt num ber from their Sum, and the remainder place und the Line, and when you go to the next Figure belo pay an Unit by adding it thereto for the ten you bo rowed before, and ſubſtract that from the higher num ber or figure : And thus go on until your Subſtracti be finiſhed. As for Example, Let 437503 be give from whence it is required to ſubſtract 153827, I d ſpoſe of the numbers as is before directed, and as y ſee in the margent ; then I begin ſaying 7 from 3 cannot, but (adding 10 thereto I ſay) 7 from 13 an there remains 6 which I ſet under the Line in order ; then I proceed to the next Figure, ſaying 1 that I borrowed and 2 is 3 from 0 I cannot, but 3 from 10 and there remains 7, which I likewiſe ſet down as before ; ; then 1 that I borrowed and 8 is 9 from 5 I cannot, but 9 from 15 and there remains 6 ; then 1 I borrow ed and 3 is 4, from 7 and there remains 3 ; then from 3 I cannot, but 5 from 13 and there remains 8 then 1 I borrowed and 1 are 2, from 4 and there reſ 2 : And thus the Work is finiſhed ; and after thei numbers are ſubſtracted one from another, the Inequality, Remainder, Exceſs or Difference is found to b 283676.

437503
153827
———
283676
———

283676. Examples for thy further Experience may be theſe that follow.

From	3475015	*From*	3615746
Take	738642	*Take*	5864
Reſts	2736374	*Reſts*	3609882

6. If the *Sum* or *Numbers* to be *Subſtracted*, are of ſeveral Denominations, place the leſſer *Sum* below the greater, and in the ſame rank and order as is ſhewed in Addition of the ſame *Numbers*; then begin at the Right hand and take the lower *number* out of the uppermoſt if it be leſſer; but if it be bigger than the uppermoſt, then borrow an Unit from the next greater Denomination, and turn it into the Parts of the leſs Denomination, and add thoſe parts to the uppermoſt Number, and from their *Sum* ſubſtract the lowermoſt, noting the remainder below the Line; then proceed and pay 1 to the next Denomination for that which you borrowed before, and proceed in this order until the work be finiſhed. An Example of this Rule may be this that followeth, let 375 *l.* 13*s.* 07 *d.* 1 *qr.* be given, from whence let it be required to *ſubſtract* 57 *l.* 16 *s.* 03 *d.* 2 *qrs.* In order whereunto I place the numbers as you ſee in the Margent, and thus I begin at the leaſt Denomination, ſaying two from one I cannot, therefore I borrow one penny from the next Denomination and turn it into Farthings, which is 4, and adding 4 to 1 which is 5, I ſay, but 2 from 5 and there remains 3, which I put under the line; then going on, I ſay, 1 that I borrowed and 3 is 4, from 7 and there reſts 3; then going on, I ſay 16 from 13 I cannot, but (borrowing one pound and turning it into 20 ſhillings, I add it to 13, and that is 33) wherefore I ſay, ſixteen from 33, and there remains 17, which I ſet under the line and go on, ſaying 1 that I borrowed and 7 is 8, from 5 I cannot, but 8 from 15 and there remains 7; the one that I

l.	*s.*	*d.*	*qrs.*
375	13	07	1
57	16	03	2
317	17	03	3

borrowed and 5 is 6, from 7 there reſts 1, and 0 fro 3 reſts 3, and the work is done: And I find the r mainder or difference to be 317 l. 17 s. 03 d. 3 qr

Another Example of *Troy-Weight* may be this, would ſubſtract 17 *l.* 10 *oz.* 11 *p.w.* 20 *gr.* from 24 05 *oz.* 00 *p.w.* 08 *gr.* I place the Numbers according to the Rule, and begin, ſaying 20 from 8 I cannot, but borrow 1 *penny weight*, which is 24 *grains*, and add them to 8, and they are 32, wherefore I ſay 20 from 32 reſt 12; then 1 that I borrowed and 11 is 12, from 00 I cannot, but 12 from 20 (borrow ing an Ounce which is 20 *penny weight*) and there r main 8; then 1 that I borrowed and 10 is 11, from I cannot, but 11 from 17 and there reſts 6; then 1 th I borrowed and 7 is 8, from 4 I cannot, but 8 fro 15 and there reſts 6; then 1 that I borrowed and 1 is from 2 and there reſts nothing; ſo that I find the R mainder or difference to be 6 *l.* *oz.* 8 *p.w.* 12 *gr.*

l.	*oz.*	*p.w.*	*g*
24	05	00	
17	10	11	
06	06	08	11

7. It many times happeneth that you have man *Sums* or *Numbers* to be *ſubſtracted* from one *number*; ſuppoſe a Man ſhould lend his Friend a certain ſum money, and his Friend had paid him part of his Deb at ſeveral times, then before you can convenient know what is ſtill owing, you are to add the ſever *Numbers* or *Sums* of Payment together, and *ſubſtra* their *Sum* from the whole Debt, and the Remainder the *Sum* due to the Creditor, as ſuppoſe A lendeth B 564 *l.* 13 *s.* 10 *d.* and B hath repaid him 79 *l.* 16 *s.* 08 *d.* at one time, and 163 *l.* 18 *s.* 11 *d.* at another time, and 241 *l.* 15 *s.* 08 *d.* at another time; and you would know how the Accompt ſtandeth between them, or what is more due to A. In order whereunto

	l.	*s.*
Lent	564	11
Paid at ſeveral payments	79	16
	163	18
	251	15
Paid in all	485	11
Remains	79	02

I firſt ſet down the *Sum* which A lent, and draw a line underneath it, then under that line ſet the ſeveral *Sums* of payment as you ſee in the Margent; and having brought the ſeveral Sums of payment into one total by the fifth Rule of the fourth Chapter foregoing, I find their *Sum* amounteth to 485 *l.* 11 *s.* 3 *d.* which I ſubſtract from the *Sum* firſt lent by A. by the ſixth Rule of this Chapter, and I find the Remainder to be 79 *l.* 2 *s.* 7 *d.* And ſo much is ſtill due to A.

When the Learner hath good knowledge of what hath been already delivered in this and the foregoing Chapter, he will with eaſe underſtand the manner of working the following Examples.

Subſtraction of whole Money.

	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*qrs.*
Borrowed	374	10	03	700	10	11	2
Paid	79	15	11	9	03	11	3
Remains	304	14	04	691	06	11	3

	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*qrs.*
Borrowed	1000	00	00	711	03	00	0
Paid	19	00	06	11	13	00	1
Rem. due	980	19	06	699	09	11	3

Borrowed	3300	00	00	0
Paid at ſeveral payments	170	10	00	0
	361	13	10	1
	590	03	04	3
	73	04	11	3
Paid in all	1195	12	02	3
Remain due	2104	07	09	3

Subſtraction of Troy Weight.

	l.	oz.	p.w.	gr.
Bought	174	00	13	00
Sold	78	04	16	15
Remains	95	07	16	09

	l.	oz.	p.w.	gr.
Bought	470	10	13	00
Sold at ſeveral Times	60	00	00	00
	35	10	18	00
	16	07	09	08
	48	04	00	00
	61	11	19	23
	23	00	00	00
Sold in all	245	10	07	07
Rem. unſold	225	00	05	17

Subſtraction of Apothecaries Weights.

	l.	oz.	dr.	ſcr.	gr.	l.	oz.	dr.	ſcr.	gr
Bought	12	04	3	0	00	20	00	1	0	07
Sold.	8	05	1	1	15	10	00	1	2	1
Remains	3	11	1	1	05	9	11	7	0	15

Subſtraction of Averdupois Weight.

	C.	qrs.	l.	Tun	C.	qrs.	L.	oz.	dr
Bought	25	0	15	5	07	1	10	10	05
Sold	16	2	20	3	17	1	16	09	13
Remains	18	2	20	1	09	3	22	00	08

Sub-

Subſtraction of Liquid Meaſure.

	Tun	*hhd.*	*gall.*	*Tun.*	*hhd.*	*gall.*	*pec.*
Bought	40	1	30	60	3	42	4
Sold	16	1	40	15	3	46	6
Remains	23	3	53	44	3	58	6

Subſtraction of Dry Meaſure.

	Chald.	*qrs.*	*buſh.*	*pec.*	*Chal.*	*qrs.*	*buſh.*	*pec.*
Bought	100	0	00	0	73	2	3	2
Sold	54	1	04	3	46	2	3	3
Remains	45	2	03	1	26	3	7	3

Subſtraction of Long Meaſure.

	yards	*qrs.*	*nails*	*yards.*	*qrs.*	*nails*
Bought	160	1	0	344	0	1
Sold	64	1	2	177	1	3
Remains	95	3	2	166	2	2

Subſtraction of Land Meaſure.

	Acres	*rood.*	*per*	*Acres*	*rood.*	*per.*
Bought	140	2	13	600	0	00
Sold	70	3	22	54	0	16
Remains	69	2	31	545	3	24

The Proof of Subſtraction.

8. When your *Subſtraction* is ended, if you deſire

to prove your work, whether it be true or no, then add the remaindert to the minor *Number*, and if th *Aggregate* of theſe two be equal to the major *Number* then is your Operation true, otherwiſe falſe; thus le us prove the firſt *Example* of the fifth Rule of thi *Chapter*, where after *Subſtraction* is ended, the *Numbers* ſtand as in the *Margent*; the Remainder or difference being 283676. Now to prove the Work, I add the ſaid Remainder 283676 to the minor number 153827, by the fourth Rule of the foregoing Chapter, and I find the Sum or *Aggregate* to be 437503 equal to the major Number, or Number from whence the leſſer is *ſubſtracted*; behold the work in the *Margent*.

437503
153827
———
283676

437503
153827
———
283676
———
437503

The Proof of another *Example* may be of the firſt *Example* of the ſixth *Rule* of this *Chapter*, where it is required to *ſubſtract* 57 *l.* 16 *s.* 03 *d.* 2 *qrs.* from 375 *l.* 13 *s.* 07 *d.* 1 *qr.* and by the *Rule* I find the *Remainder* to be 317 *l.* 17 *s.* 3 *d.* 3 *qrs.* now to prove it, I add the ſaid *Remainder* 317 *l.* 17 *s.* 3 *d.* 3 *qrs.* to the minor *number* 57 *l.* 16 *s.* 03 *d.* 02 *qrs.* and their ſum is 375 *l.* 13 *s.* 07 *d.* 1 *qr.* equal to the major *number*, which proves the work to be true, but if it had happened to have been either more or leſs than the ſaid major *number*, then the *operation* had been falſe.

l.	*s.*	*d.*	*qr.*
375	13	07	1
57	16	03	2
317	17	03	3
375	13	07	1

9. The general effect of *Subſtraction* is to find the differences or exceſs between two *numbers*, and the reſt when a payment is made in part of a greater Sum, the date of Books printed, the age of any thing by knowing the preſent year, and the year wherein they were made, created or built, and ſuch like.

The Queſtions appropriated to this Rule are ſuch as follow.

Queſt. 1. What difference is there between one thing of 125 foot long and another of 66 foot long?

To reſolve this Queſtion, I firſt ſet down the major or greater *number* 125, and under it the minor or leſſer *number* 66, as is directed in the third *Rule* of this Chapter, and according to the fourth Rule of the ſame I *ſubſtract* the minor from the major, and the Remainder, Exceſs or Difference I find to be 59; ſee the Work in the *Margent*.

$$\begin{array}{r}125\\66\\\hline 59\\\hline\end{array}$$

Queſt. 2. A Gentleman oweth a *Merchant*, 365 *l.* whereof he hath paid 278 *l.* what more doth he owe?

To give an *Anſwer* to this *Queſtion*, I firſt ſet down the major *number* 365 *l.* and under it I place 278 the *minor*, and *ſubſtract* the one from the other, and thereby I diſcover the Exceſs, Difference or Remainder to be 87, and ſo much is ſtill due to the Creditor. As *per Margent*.

$$\begin{array}{r}365\\278\\\hline 87\\\hline\end{array}$$

Queſt. 3. An obligation was written; a book printed, a Child born, a Church built, or any other thing made in the year of our Lord 1572, and now we account the year of our Lord 1687, the *Queſtion* is to know the age of the ſaid things, that is, how many years are paſſed ſince the ſaid things were made; I ſay if you *ſubſtract* the leſſer *number* 1572, from the greater 1687, the remainder will be 115; and ſo many yeaas are paſt ſince the making of the ſaid things; as by the Work in the *Margent*.

$$\begin{array}{r}1687\\1572\\\hline 115\\\hline\end{array}$$

Queſt. 4. There are three Towns lie in a ſtreight line, *viz.* *London*, *Huntington*, and *York*, now the Diſtance between the fartheſt of theſe Towns, *viz.* *London* and *York* is 151 miles, and from *London* to *Huntington* is 49 miles, I demand how far it is from *Huntington* to *York*.

To reſolve this *Queſtion*, *ſubſtract* 49 the diſtance between *London* and *Huntington*, from 151 the diſtance between *London* and *York*, and the Remainder is 102, for the true diſtance between *Huntington* and *York*. See the Work in the *Margent*.

15
4
10

CHAP. VI.

Of Multiplication of whole Numbers.

1. *MUltiplication* is performed by two *numbers* of like kind for the *Production* of a third, which ſhall have ſuch reaſon to the one, as the other hath to Unit, and in Effect is a moſt brief and artificial compound *Addition* of many equal *Numbers* of like kind into one Sum. Or *Multiplication* is that by which we *multiply* two or more *numbers*, the one into the other, to the end that their Product may come forth, or be diſcovered.

Or, *Multiplication*, is the increaſing of any one *number* by another; ſo often as there are Units in that *number*, by which the other is increaſed, or by having two *numbers* given to find a third, which ſhall contain one of the *Numbers* as many times as there are Units in the other.

2. *Multiplication* hath three parts, firſt the *Multiplicand*, or *number* to be *multiplyed*. Secondly, the *multiplyer*, or *number* given, by which the *multiplicand* is to be *multiplied*. Atd thirdly, the *product* or *number*, produced by the other two, the one being multiplyed by the other, as if 8 were given to be multiplyed by 4. I ſay 4 times 8 is 32, here 8 is the *Multiplicand*, and 4 is the *multiplyer*, and 32 is the Product.

8
4

3. *Multiplication* is either ſingle by one Figure, or compound that conſiſts of many.

Single *Multiplication* is ſaid to conſiſt of one figure, becauſe the *Multiplicand* and *Multiplyer* conſiſt each of them of a Digit,and no more, ſo that the greateſt product that can ariſe by ſingle *Multiplication* is 81, being the ſquare of 9; and Compound *Multiplication* is ſaid to conſiſt of many figures, becauſe the *Multiplicand* or *Multiplier* conſiſts of more places than one; as if I were to multiply 436 by 6, it is called Compound,becauſe the *Multiplicand* 436 is of more places than one, (*viz*) 3 places.

4. The Learner ought to have all the varieties of ſingle *Multiplication* by heart before he can well proceed any further in this Art, it being of moſt Excellent Uſe, and none of the following Rules in *Arithmetick* but what have their principal dependance thereupon, which may be learnt by the following Table.

Multiplication Table.

1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	18	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

The uſe of the precedent Table is this. In the uppermoſt Line or Column you have expreſſed all the digits from 1 to 9; and likewiſe beginning at 1 and going downwards in the ſide Column you have the ſame; ſo that if you would know the Product of any two ſingle numbers multiplyed by one anothe look for one of them (which you pleaſe) in the up permoſt Column, and for the other in the ſide Column and running your eye from each figure along the re ſpective Column, in the common Angle (or plac where theſe two Columns meet, there is the produc required. As for Example, I would know how muc is 8 times 7, firſt I look for 8 in the uppermo Column, and 7 in the ſide Column; then do I ca my eye from 8 along the Column downwards fro the ſame, and likewiſe from 7 in the ſide Column, caſt my eye from thence towards the Right-hand and find it to meet with the firſt Column at 56, ſo tha I conclude 56 to be the Product required, it woul have been the ſame if you had looked for 7 in th top, and 8 on the ſide, the like is to be underſtoo of any other ſuch Numbers. The Learner being per fect herein, it will be neceſſary to proceed.

5. In Compound *Multiplication*, if the *Multiplican* conſiſts of many places, and the *Multiplyer* of bu one figure; firſt ſet down the *Multiplicand*, an under it place the *Multiplyer* in the place of Units and draw a Line underneath them; then begin and multiply the *Multiplier* into every particula figure of the *Multiplicand*, beginning at the place o Units, and ſo proceed towards the left hand, ſetting each particular Product under the Line, in order a you proceed, but if any of the Products exceed 10 o any number of Tens, ſet down the Exceſs, and fo every 10 carry a Unit to be added to the next produc always remembring to ſet down the Total product o the laſt figure; which work being finiſhed, the Sum or Number placed under the Line ſhall be the tru and Total Product required. As for Example, I would multiply 478 by 6, firſt I ſet down 478, and underneath it 6 in the place of Units, and draw a line underneath them as in the Margent, then I begin, ſaying 6 times 8 is 48, which is 8 above 4 Tens, therefore I ſet down 8 (the exceſs) and bear 4 in mind for the four Tens, then I proceed, ſay-

```
 478
   6
────
2868
```

ng 6 times 7 is 42, and 4 that I carried is 46, I then et down 6 and carry 4, and go on, ſaying 6 times 4 is 4, and 4 that I carried is 28, and becauſe it is the aſt figure, I ſet it all down, and ſo the work is fi-iſhed, and the product is found to be 2868, as was equired.

6. When in Compound *Multiplication* the Multiplier onſiſteth of divers places, then begin with the fi-ure in the place of Units in the *M*ultiplyer, and ultiply it into all the figures in the multiplicand, lacing the product below the line as was directed in he laſt Example; then begin with the figure of the econd place of the multiplier, (*viz.*) the place of Tens, and multiply it likewiſe into the whole multiplicand (as you did the firſt figure) placing its product nder the product of the firſt figure, do in the ſame anner by the third, fourth and fifth, *&c.* until you ave multiplyed all the figures of the multiplyer par-icularly into the whole multiplicand,ſtill placing the roduct of each particular figure under the product f its precedent figure; herein obſerving the follow-ng Caution.

A Caution

In the placing of the product of each particular figure of the multiplier, you are not to follow the 2*d.* Rule of the 4*th.* hapter,*viz.* not to place Units under Uunits,and Tens under Tens, *&c.* but to put the figure or Cypher in he place of Units of the ſecond line under the ſecond igure or place of the Tens in the line above it, and the igure or Cypher in the place of Units of the third ine under the place of Tens in the ſecond line, *&c.* bſerving this order till you have finiſhed the work, *viz.*ſtill placing the firſt figure of every line or product under the ſecond Figure or place of Tens in that which was above it, and having ſo done, draw a line under all theſe particular products, and add them together; ſo ſhall the ſum of all theſe Products be the Total product required.

As if it were required to multiply 764 by 27, I ſet them down the one under the other with a line drawn underneath them ; then I begin, ſaying 7 times 4 is 28, then I ſet down 8, and carry 2, then ſay 7 times 6 is 42, and 2 that I carried is 44, that is 4 and go 4 ; then 7 times 7 is 49, and 4 that I carry is 53, which I ſet down becauſe I have not another Figure to multiply ; thus have I done with the 7, then I begin with the 2, ſaying 2 times 4 is 8, which I ſet down under (4) the ſecond Figure place of Tens in the Line above it, as you may in the Margent : Then I proceed, ſaying 2 time is 12, that is two and carry one, then 2 times 7 is and 1 that I carry is 15, which I ſet down becau 'tis the product of the laſt Figure ; ſo that the prodi of 764 by 27 is 5348, and by 2 is 1528, which be placed the one under the other as before is directi and as you ſee in the Margent, and a Line dra under them, and they added together reſpective make 20628 the true Product required, being eq to 27 times 764.

5
15
200

Another Example may be this ; Let it be requi to multiply 5486 by 465, I diſpoſe of the Multiplicand and Multiplyer, according to the Rule, and begin multiplying the firſt Figure of the Multiplyer, which is five into the whole Multiplicand, and the Product is 27430 ; then I proceed and multiply the ſecond Figure (6) of the multiplier into the multiplicand, and find the product to amount to 32916 which is ſubſcribed under the other product reſpectively, then do I multiply the third and laſt figure (4) of the multiplyer into the multiplicand, and the Product 21944, which is likewiſe placed under the ſeco Line reſpectively ; then I draw a Line under the ſ Products (being placed the one under the other acco ing to this Rule) and add them together, and the ſu is 2550990 the true Product ſought, being equal 5486 times 465, or 465 times 5486.

54
4
274
3291
21944
25509

M

More Examples in this Rule are theſe following.

```
   430865
     4739
  -------
  3877785
 1292595
3016055
1723460
---------
2041869235
```

```
    6400758
      37496
   --------
   38404548
  57606822
 25603032
44805306
19202274
-------------
240002821968
```

Compendium in Multiplication.

7. Although the former Rules are ſufficient for all Caſes in Multiplication, yet becauſe in the Work of Multiplication many times great labour may be ſaved, I ſhall acquaint the Learner with ſome Compendiums in order thereto, *viz.* If the Multiplicand or Multiplyer, or both of them end with Cyphers, then in your multiplying you may neglect the Cyphers, and multiply only the ſignificant Figures, and to the Product of thoſe ſignificant Figures, add ſo many Cyphers as the Numbers given to be multiplied did end with; that is, annex them on the Right hand of the ſaid product, ſo ſhall that give you the true product required. As if I were to multiply 32000 by 4300, I ſet them down in order to be multiplyed as you ſee in the Margent, but neglecting the Cyphers in both numbers I only multiply 32 by 43, and the Product I find to be 1376, to which I annex the 5 Cyphers that are in the Multiplicand and Multiplyer, and then it makes 137600000 for the true Product of 32000 by 4300.

Si e numeris propoſitis unus vel uterque adjunctos habeat ad dextram circulos; omſſis circulis fiat ipſorum numerorum multiplicatio, & facto demum tot inſuper integrorum loci accenſeantur quot ſunt omiſſi circuli in utroque factore, Clavis Mac. c. 4. 3.

```
    32000
     4300
    -----
     96
    128
---------
137600000
```

8. If

Si intermedio multiplicanti co circulus fuerit, iſte neglig Alſted. Cap. 9. de Arithm.

8. If in the Multiplyer Cyphers are placed tween ſignificant figures, then multiply only by the ſignificant Figures neglecting the Cyphers, but here ſpecial notice is to be taken of the true placing of the firſt fig after the neglect of ſuch Cyphers or Cyphers ; a therefore you muſt obſerve in what place of the m tiplier the Figure you multiply by ſtandeth, and the firſt figure of that product under the ſame pl of the product of the firſt figure of your multiplye As for Example, let it be required to multiply 3715 by 4007, firſt I multiply the multiplicand by 7, and the product is 2600976, then neglecting the Cyphers I multiply by 4, and that Product is 1486272, now I conſider that 4 is the fifth figure in the Multiplier, therefore I place two (the firſt figure of the product by four) under the fifth place of the firſt Product by 7, and the reſt in order, and having added them gether, the Total product is found to be 148653209 other Examples in this Rule are theſe following.

3715
400

2600
1486272

148653209

327586
6030

9827480
1965516

1975343580

7864371
20604

31457484
47186226
15728742

162037500084

9. If you are to multiply any Number by an U with Cyphers, (*viz.*) by 10, 100, 1000, &c. th annex ſo many Cyphers before the multiplicand, that *number* when the Cyphers are annexed is the P duct required ; as if you would multiply 428 by 1 annex two Cyphers to 428 and it is 42800 : If it w requi

quired to multiply 102 by 10000, annex 4 Cyphers d it gives 1020000 for the Product required.

The Proof of Multiplication.

10. Multiplication is proved by Diviſion, and to eak truth all other ways are falſe; and therefore it ll be moſt convenient in e firſt place, to learn Di-ſion, and by that to prove ultiplication. There is a ay (at this day generally uſed in Schools) to prove ultiplication, which is this, firſt add all the Figures the multiplicand together, as if they were ſimple umbers, caſting away the Nines as often as it comes ſo much, and noting the remainder at laſt, which th's caſe cannot be ſo much as 9: Caſt likewiſe the ines out of the multiplier as you did out of the mul-plicand, and note that remainder; then multiply the emainders, the one by the other, and caſt the Nines at of that Product, obſerving the Remainder; and ſtly, caſt the Nines out of the Total Product, and if is remainder be equal to the remainder laſt found, en they conclude the Work to be rightly perform-l; but there may be given a thouſand (nay infinite) lſe Products in a multiplication, which after this anner may be proved to be true, and therefore this ay of proving doth not deſerve any Example; but e ſhall defer the Proof of this Rule till we come to rove Diviſion, and then we ſhall prove them both ogether.

Non eſt quod aliam expectes examinandi viam; nam aliæ vulgares & falſæ ſunt, & nullo innixæ fundamento.

11. The general effect of Multiplication is contained n the definition of the ſame, which is to find out a d. Number, ſo often containing one of the two given umbers as the other containeth Unit,

The ſecond effect is by having the length and readth of any thing (as a Parallelogram, or long lain) to find the ſuperficial Content of the ſame, and y having the ſuperficial Content of the Baſe and the ength to find out the ſolidity of any Parallelopipedon, ylinder or other ſolid figures.

The third Effect is by the contents, price, value buying, ſelling, expence, wages, exchange, ſimpl intereſt, gain or loſs of any one thing, be it Money Merchandize. *&c.* to find out the value, price, expence, buying, ſelling, exchange, or intereſt of any Number of things of like Name, Nature and Kind.

The fourth effect is (not much unlike the other by the Contents, Value, or Price of one part of any thing Denominated, to find out the Content, Value or Price of the whole thing, all the parts into which the whole is divided, multiplying the price of one of thoſe parts.

The fifth effect is, to aid, to compound, and to make other Rules, as chiefly the *R*ule of Proportion, called the Golden Rule, or Rule of Three; alſo by it, things of one *D*enomination are reduced to another.

If you multiply any number of Integers or the price of the Integer, the Product will diſcover the price of the Quantity or Number of Integers given.

In a Rectangular Solid, if you multiply the breadth of the Baſe by the depth, and that Product by the length, this laſt Product will diſcover the Solidity or Content of the ſame Solid.

Some Queſtions proper to this Rule may be theſe following.

Queſt. 1. What is the Content of a ſquare piece of Ground, whoſe length is 28 *perches*, and breadth 13 *perches*?

Anſw. 364 ſquare *perches*, for multiplying 28 the length by 13 the breadth, Product is ſo much.

Queſt. 2. There is a ſquare battle whoſe Flank is 47 Men, and the Files 19 deep, what number of *M*en doth that Battle contain? *Facit* 893; for multiplying 47 by 19, the Product is 893.

Queſt. 3. If any one thing coſt 4 ſhillings, what ſhall 9 ſuch things coſt? *Anſwer* 36 ſhillings; for multiplying 4 by 9, the Product is 36.

Queſt. 4. If a piece of *M*ony or *M*erchandize be worth or coſt 17 ſhillings, what ſhall 19 ſuch pieces

Money or Merchandize coſt? *Facit* 323 ſhillings,
ch is equal to 16 *l.* 03 *s.*

Queſt. 5. If a Soldier or Servant get or ſpend 14 *s.*
Month, what is the Wages or Charges of 49 Sol-
s or Servants for the ſame time? Multiply 49 by
the Product is 686 *s.* or 34 *l.* 06 *s.* for the *Anſwer.*

ueſt. 6. If in a day there are 24 hours, how many
rs are there in a year, accounting 365 days to con-
ate the year? *Facit* 8760 hours, to which if you
the 6 hours over and above 365 days as there is in
ear; then it will be 8766 hours, now if you multi-
this 8766, by 60, the number of Minutes in an
r, it will produce 525960 for the number of Mi-
es in a Year.

CHAP. VII.

Of Diviſion of Whole Numbers:

DIVISION is the ſeparating or parting of any
Number or Quantity given into any parts aſſi-
d; or to find how often one Number is contained
nother: Or from any two Numbers given to find
ird that ſhall conſiſt of ſo many Units, as the one
hoſe two given Numbers is comprehended or con-
ed in the other.

. Diviſion hath three Parts or Numbers remarkable,
Firſt the Dividend. Secondly, the Diviſor. Thirdly,
Quotient. The Dividend is the Number given to
parted or divided. The Diviſor is the Number
n, by which the Dividend is divided: Or it is the
mber which ſheweth how many parts the Dividend
be divided into, And the Quotient is the number
duced by the Diviſion of the two given Numbers,
one by the other.

o 12 being given to be divided by 3, or into three
al parts, the Quotient will be 4. for 3 is contained in
four times, where 12 is the Dividend, and 3 is the
iſor, and 4 is the Quotient.

3. In Diviſion ſet down your Dividend, and dra a crooked line at each end of it, and before the line the left hand, place the Diviſor, and behind that o the right hand, place the Figures of the Quotient, as in the Margent, where it is required to divide 12 by 3: Firſt I ſet down 12 the dividend, and on each ſide of it do draw a crooked line, and before that on the left han do I place 3 the diviſor; then do I ſeek how often is contained in 12, and becauſe I find it 4 times, I p 4 behind the crooked line on the right hand of th Dividend, denoting the Quotient.

3) 12 (

4. But if when the diviſor is a ſingle Figure, th dividend conſiſteth of two or more places, then (h ving placed them for the Work as is before directe put a point under the firſt figure and the left hand the dividend, provided it be bigger than (or equ to) the diviſor, but if it be leſſer than the diviſo then put a point under the ſecond Figure from the le hand of the Dividend, which Figures as far as th point goeth from the left hand are to be reckoned b themſelves, as if they had no dependance upon th other part of the dividend, and for diſtinction ſa may be called the dividual, that ask how often th diviſor is contained in the dividual, placing the An ſwer in the quotient; then multiply the diviſor by th Figure that you placed in the Quotient, and ſet th Product thereof under the dividual; then draw line under that product, and ſubſtract the ſaid produ from the dividual, placing the remainder under th ſaid line, then put a point under the next Figure the dividend, on the right hand of that which you p the point before, and draw it down, placing it on th right hand of the remainder, which you found Subſtraction; which remainder with the ſaid figure a nexed before it, ſhall be a new dividual; then ſe again how often the diviſor is contained in this n dividual; and put the Anſwer in the quotient on t right hand of the figure which you put there befo then multiply the diviſor by the laſt figure that y

at in the Quotient and ſubſcribe the Product under e Dividual, and make Subſtraction, and to the Remainder draw down the next Figure from the grand ..dend, (having firſt put a point under it) and put on the right hand of the Remainder for a new di- idual as before, *&c.* and proceed thus till the Work finiſhed.

Obſerving this general Rule in all kinds of Diviſion, rſt to ſeek how often the diviſor is contained in the ividual; then (having put the anſwer in the Quo- ent) multiply the diviſor thereby, and ſubſtract the roduct from the dividual. An Example or two will ake the Rule plain. Let it be required to divide 184 by 6. I diſpoſe of the Numbers given as is be- re directed, and as you ſee in the Mar- ent, in order to the Work; then (becauſe the diviſor is more than 2 the firſt Fi- ure of the dividend) I put a point un- er 1 the ſecond Figure, which makes the 21 for the ividual, then do I ask how often 6 the iviſor is contained in 21, and becauſe I annot have it more than 3 times, I ut 3 in the Quotient, and thereby do I ultiply the diviſor (6) and the product 18, which I ſet in order under the di- idual, and ſubſtract it therefrom, and e Remainder (3) I place in order under the line, as ou ſee in the Margent.

```
6)2184(
   .
```

```
6) 2184 (3
    .
   18
   ----
    3
```

Then do I make a point under the ext Figure of the dividend being 8, and raw it down, placing it before the Re- ainder 3, ſo have I 38 for a new divi- ual, then do I ſeek how often 6 is con- ined in 38, and becauſe I cannot have ore than 6 times, I put 6 in the Quo- ent, and thereby do I multiply the di- ſor 6, and the product (36) I put under e dividual (38) and ſubſtract it there- om, and the remainder 2 I put under the Line, as ou ſee in the Margent.

```
6)2184(36
    ..
   18
  ----
   38
   36
  ----
    2
```

Then do I put a point under the next (and laſt) gure of the dividend (being 4) and draw it down to the remainder 2, and putting it on the Right hand thereof, it maketh 24 for a new dividual; then I ſeek how often 6 is contained in 24, and the Anſwer is 4, which I put in the quotient and multiply the Diviſor (6) thereby; and the product (24) I put under the dividual (24) and ſubſtract it therefrom, and the Remainder is 0, and thus the Work is finiſhed, and I find the Quotient to be 364, that is, 6 is contained in 2184 juſt 364 times, or 2184 being divided into 6 equal parts, 364 is one thoſe parts.

6)2184)3
 . . .
 18

 38
 36

 24
 24

 00

Again, If it were required to divide 2646 by 7 into 7 equal parts, the Quotient would be found be 378, as by the following Operation appeareth.

7) 2646 (378
 . . .
 21

 54
 49

 56
 56

 00

So if it were required to divide 946 by 8, the C tient will be found to be 118, and 2 remaining a Diviſion is ended. The Work followeth.

```
8) 946 (118
   ...
   8
  ---
   14
    8
  ---
    66
    64
   ---
   (2)
```

Many times the dividend cannot exactly be divided
the diviſor, but ſomething will remain, as in the
Example,where 945 was given to be divided by 8,
quotient was 118 and there remaineth 2 after the
iſion is ended : Now what is to be done in this
e with the Remainder, the Learner ſhall be taught
en we come to treat of reducing (or Reduction)
Fractions.

And here note that if after your Diviſion is ended,
thing do remain, it muſt be leſſer than your divi-
,for otherwiſe your Work is not rightly performed.

Other Examples are ſuch as follow.

```
8) 73464 (9183          9) 13758 (1528
   ....                    ....
   72                      9
  ---                     ---
   14                      47
    8                      45
  ---                     ---
    66                      25
    64                      18
   ---                     ---
     24                      78
     24                      72
    ---                     ---
    (0)                     (6)
```

5. But if the Diviſor conſiſteth of more places th
one, then chuſe ſo many Figures from the left ſide
the dividend for a dividual as there are figures in t
diviſor. and put a point under the fartheſt Figure
that Dividual to the Right hand, and ſeek how oft
the firſt Figure on the left ſide of the Diviſor,
contained in the firſt Figure on the left ſide of t
dividual, and place the Anſwer in the Quotient, a
thereby multiply your Diviſor, placing your produ
under your dividual, and ſubſtract it therefrom, p
cing the Remainder below the line; then put a poi
under the next Figure in the Dividend, and draw
down to the ſaid Remainder, and annex it on the rig
ſide thereof, which makes a new dividual, and proce
as before, till the work is finiſhed.

And if it ſo happen that after you have choſen yo
firſt dividual (as is before directed) you find it to
leſſer than the diviſor, then put a point under a figu
more near to the right hand, and ſeek how often t
firſt Figure on the left ſide of the diviſor is contain
in the two firſt Figures on the left ſide of the dividu
and place the anſwer in the quotient, by which mul
ply the diviſor, and place the product thereof in o
der under the dividual, and ſubſtract it therefro
and proceed as before.

Always remembring, that (in all the caſes of Di
ſion) if after you have multiplyed your Diviſor
the Figure laſt placed in the Quotient, the product
greater than the dividual, then you muſt cancel th
Figure in the Quotient, and inſtead thereof put a
gure leſſer by a Unit (or one) and multiply he Di
for thereby, and if ſtill the product be greater th
the dividual, make the figure in the quotient yet leſ
by a Unit, and thus do until your product be leſ
than the dividual, or at the moſt equal thereto, a
then make Subſtraction, &c.

So if you would diuide 9464 by 24, the quoti
will be found to be 394, I firſt put down the gi
Numbers, as before is directed in the third Rule: N

becau

cauſe my Diviſor conſiſteth of two gures, I therefore put a point under e ſecond Figure from the left hand my Dividend, which here is 4, herefore I ſeek how often 2 the firſt gure (on the left ſide of the Diviſor) contained in 9) the like firſt in the vidual) the anſwer is 4, which I put in the quotient, d thereby multiply all the diviſor and find the pro- ct to be 96, which is greater than the dividual 94, hereof I cancel the 4 in the quotient, and inſtead ereof I put 3 (a Unit leſſer) and by it multiply the viſor 34, and the product is 72, which I ſubſtract om 94 the Dividual, and the Remainder is 22, then I make a point under the next figure 6 in the Divi- nd, and draw it down and place it the right ſide of the Remainder 22, d it makes 226 for a new dividual, w becauſe the dividual 226 conſiſt- h of a Figure more than the diviſor, erefore I ſeek how often 2 (the firſt ure of the diviſor is contained in 22 e two firſt the of diuidual) I ſay nine mes, wherefore I put 9 in the quoti- t, and thereby multiply the Diviſor , the product (216) I place under the vidual 226, and ſubſtract it from it, and there re- aineth 10.

24) 9464 (3 4
· ·
72
——
22

24) 9464 (39
· ·
——
226
216
——
10
——

Then I go on and make a point under the next and ſt Figure (4) in the Dividend, and draw it down to e Remainder 10, and it maketh 104, for a new vidual, which is alſo a figure more than the Diviſor, d therefore I ſeek how often two is, contained in n. I anſwer five times, but multiplying my Diviſor 5, the product is 120, which is greater than the Di- ſor, and therefore I make it but 4, and by it multi- y the diviſor, and the product is 96, which being pla- d under, and ſubſtracted from the dividual, there re- aineth 8, and thus the whole work of this Diviſion ended, and I find that 9464 being divided by 24, or in equal parts, is found to be 394, as was fa before, and the Remainder is 8, as you ſee in t Work following.

24) 9464 (394
72
226
216
104
96
(0)

Another Example may be this, let there be requi the quotient of 1183653 divided by 385, firſt I ſpoſe of the *numbers* in order to their dividing, and becauſe 118 the three firſt Figures of the dividend is leſſer than the diviſor 385, I therefore make a point unuer the fourth Figure, which is 3, and ſeek how often 3 (the firſt Figure of the diviſor) is contained in 11? The Anſwer is which I put in the Quotient, and thereby multiply Diviſor 385, and the Product is 1155 which I ſubſt from the Dividual 1188, and there remains 28. T (as before) I draw down the next Figure, which is 6, and place it before the Remainder 28; ſo have I 286 for a new dividual, and becauſe it hath no more Figures than the Diviſor, I ſeek how often 3 (the firſt Figure in the diviſor contained in 2 (the firſt Figure of the dividual) the Anſwer is 0, for a greater number cannot be c tained in a leſſer, wherefore I put 0 in the quoti and thereby (according to the 5*th* Rule) I ſho multiply my Diviſor, but if I do the product will be

385)118355
1155
28

385 (1183653
1155
286

l o ſubſtracted from the dividual 286,the remainder
the ſame ; wherefore I draw
wn the next Figure (5) from
dividend, and put it before
ſaid Remainder 286, ſo have
865 for a new dividual, and
auſe it conſiſteth of four pla-
, (*viz.*) a place more than the
iſor, I ſeek how often 3 (the
t Figure of the diviſor) is con-
ned in 28 (the two firſt of the
idual) and I ſay there is 9 times 3 in 28, but mul-
lying my whole diviſor (385) thereby I find the
oduct to be 3545, which is greater than the divi-
al 2865, wherefore I chooſe eight which is leſſer by
Unit than nine, and thereby I multiply my diviſor
5, and the product is 3080, which ſtill is greater
n the ſaid dividual, wherefore I chooſe another num-
yet a Unit leſſer, *viz.* 7 ; and having multiplyed
diviſor thereby, the Product is 2695, which is
ſer than the dividual 2865, wherefore I put 7 in the
otient, and ſubſtract 2695 from the dividual 2865,
there remains 170, then I draw down the laſt fi-
re (3) in the dividend, and place it before the ſaid
mainder 170 , and it makes
03 for a new dividual, then
r the Reaſon above ſaid) I
k how often 3 is contained in
, the anſwer is 5, but multi-
ing the diviſor thereby, the
oduct is (1925) greater than
dividual; wherefore I ſay
will bear 4 (a Unit leſſer) and
it I multiply the Diviſor 385
d the Product is 1540, which
eſſer than the dividual, and
refore I put 4 in the Quo-
nt, and ſubſtract the ſaid Product from the dividual,
d there remaineth 163, and thus the Work is fini-
d, and I find that 1183653 being divided by 385,

```
385)1183653(307
        ...
    1155
    ----
     2865
     2695
     ----
      170
```

```
385)1183653(3074
        ....
    1155
    ----
     2865
     2695
     ----
      1703
      1540
      ----
       163
```

or into 385 equal ſhares or parts, the Quotient (o
one of thoſe parts) is 3074, and beſides there is 16
remaining.

And thus the Learner being well verſed in the Me
thod of the foregoing Examples, he may be ſuffi
ciently qualified for the dividing of any greater Sum
or Number into as many parts as he pleaſeth, that i
he may underſtand the Method of dividing by a Div
ſor, which conſiſteth of 4 or 5, or 6, or any greate
number of places, the Method being the ſame wit
the foregoing Examples in every reſpect.

Other Examples in Diviſion.

27986) 835684790 (29860
• • • • •

55972

275964
251874

240907
223888

170199
167916

Remains (22830)

196374) 473986018 (2413
• • • •

392748

812380
785496

268841
196374

724678
589122

Remains (135556)

So if you divide 47386473 by 58736, you will find e Quotient to be 806, and 45257 will remain after e work is ended.

In like manner if you would divide 3846739204 by 3064,the quotient will be 7963 and the Remainder ter Diviſion will be 100572.

Compendiums in Diviſion.

IF any given Number be to be divided by another number that hath Cyphers annexed on the right le thereof,(omitting the Cyphers) you may cut off many Figures from the right nd of the Dividend, as there e Cyphers before the Diviſor, d let the Remaining Numrs in the Dividend, be divid by the remaining number numbers in the diviſor, obving this Caution, that if after your Diviſion is end any thing remain, you are to annex thereto, the *nber* or *numbers* that were cut off from the *dividend*; d ſuch new found *number* ſhall be the Remainder.

Et ſi Diviſor adjunctos ſibi habeat Circulos ad dextram, omiſſis circulis & abſciſſis totidem ultimis Figuris dividendi in numeris reliquis fiat diviſio, in fine autem diviſionis reſtituendi ſunt tum omiſſi circuli tum figuræ abſciſſæ: Ought. Cla. Math. cap. 5. 8.

for Example : Let it be requil to divided 46658 by 400; now cauſe there are two Cyphers bere the Diviſor, I cut off as ma- Figures from before the *Dividend*, *viz*. 58. ſo that then there ll remain only 466 to be divil by 4, and the quotient will 116, and there will remain 2, which I annex the two Figures 8) which were cut off from the *vidend*,and it makes 258 for the e remainder,ſo that I conclude 653 being divided by 400,the quotient will be 116, d 258 remaineth after the Work is ended ; as by Work in the Margent.

```
4|00)466|58(116
      ..
      4
    -----
      6
      4
    -----
      25
      24
    -----
      258
```

2. And hence it followeth that if the Diviſor be (1
or a Unit with Cyphers an-
nexed, you may cut off ſo
many figures from before
the dividend, as there are
Cyphers in the Diviſor,
and then the figure or fi-
gures that are on the Left-hand, will be the Qu
tient, and thoſe that are on the Right-hand will be th
Remainder, after the Diviſion is ended : As thus,
45783 were to be divided by 10, I cut off the laſt Fi
gure (3) with a daſh thus (4578|3) and the work
done, and the quotient is 4578 (the number on th
left hand of the daſh) and the Remainder is 3 (on th
Right hand ;) in like manner if the ſame numbe
45783 were to be divided by 100, I cut off 2 Figure
from the end thus (457|83) and the Quotient is 45
and the Remainder is 83. And if I were to divide th
ſame by a 1000, I cut off 3 Figures from the end th
(45|783) and the Quotient is 45, and 783 the Re
mainder, *&c.*

Diviſurus qu mcunque numerum p
10. Aufer ex dextra parte unica
eamque primam figuram. Reliq
enim figuræ productum oſtendu
Ablatum Reſiduum, &c. Gem. Fr
Arith. part. 1.

6. The General Effect of Diviſion is contained
the definition of the ſame (that is) by having two u
equal numbers given to find a third number in ſuc
proportion to the dividend, as the diviſor hath to Ur
or 1, it alſo diſcovers what reaſon or proportion the
is between numbers, ſo if you divide 12 by 4, it quot
3, which ſhews the reaſon or proportion of 4 to 12
triple.

The ſecond Effect is by the ſuperficial meaſure
content, and the length of any Oblong, Rectangul
Parallelogram, or ſquare Plain known, to find out t
breadth thereby, or contrariwiſe by having the ſupe
ficies, and breadth of the ſaid Figure, to find out t
length thereof. Alſo by having the ſolidity and leng
of a Solid, to find the Superficies of the Baſe, *&c. e cont*

The third effect is, by the contents, reaſon, pri
value, buying, ſelling, expences, wages, exchar
intereſt, profit or loſs of any number of things (be
Money, Merchandize, or what elſe) to find out
c

ntents, reaſon, price, value, buying, ſelling, ex-
ice, wages, exchange, intereſt, profit or loſs, of
y one thing of like kind.

The fourth effect is to aid, to compoſe, and to make
ner Rules, but principally the Rule of Proportion,
lled the Golden Rule, or Rule of Three, and the
duction of Moneys, Weights, and Meaſures, of
e denomination into another, by it alſo Fractions
e abbreviated by finding a common meaſurer, unto
e Numerator and Denominator, thereby diſcove-
ng commenſurable numbers.

If you divide the value of any certain quantity,
the ſame quantity, the quotient diſcovers the rate
value of the Integer, as if eight yards of Cloth coſt
ſhillings; if you divide (96) the value or price
the given quantity, by (8) the ſame quantity, the
otient will be 12, which is the value or price of
of thoſe yards, *&c contra.*

If you divide the Value or Price of any unknown
antity, by the value of the Integer, it gives you in
e Quotient that unknown quantity whoſe price is
us divided; as if 12 ſhillings were the value of 1
rd, I would know how many yards are worth 96 ſhil-
ngs: Here if you divide (96) the price or value of
e unknown quantity, by (12) the rate of the Inte-
r, or one yard, the quotient will be 8, which is the
umber of yards worth 96 ſhillings.

ne Queſtions anſwered by Diviſion may be theſe following.

Queſt. 1. If 22 things coſt 66 ſhillings, what will 6
ch things coſt; *facit* 3 ſhillings, for if you divide 61
y 22, the Quotient is 3 for the Anſwer; ſo if 3*l.*
ard or ells of any thing be bought or ſold for 108 6
ow much ſhall 1 yard or ell be bought or ſold for?
cit 3 *l.* for if you divide 108 *l.* by 36 yards, the
uotient will be 3 *l.* the price of the Integer.

Queſt. 2. If the Expence, Charges or Wages of 7
ars amount to 868 *l.* what is the Expence, Charges
Wages of one year? *facit* 124 *l.* for if you divide

868

868 (the Wages of 7 years) by 7 (the Number o Years) the Quotient will be 124 *l.* for the Anſwer ſe the Work.

7) 868 (124
7
16
14
28
28
(0)

Queſt. 3. If the content of our Superficial Foot b 144 Inches, and the breadth of a board be 9 inche how many inches of that board in length will mak ſuch a foot? *facit* 16 inches; for by dividing; 144 (th number of ſquare Inches in a ſquare Foot,) by 9 (th Inches in the breadth of the board) the Quotient is 1 for the number of Inches in length of that board t make a ſuperficial Foot.

9) 144 (16 *Inches*
9
54
54
(0)

Queſt. 4 If the content of an Acre of Ground b 160 ſquare Perches, and the length of a Furlong (propounded) be 80 Perches, how many Perches will ther go in breadth to make an Acre, *facit* 2 Perches; for you divide 160 (the number of Perches in an Acr by 80 (the length of the Furlong in Perches) th Quotient is 2 Perches; and ſo many in breadth of th Furlong will make an Acre.

80) 160 (2 *Perches*

160

(0)

Queſt. 5. If there be 893 Men to be made up into a attle, the Front conſiſts of 47 Men, what *number* muſt here be in the File? *Facit* 19 deep in the File : For f you divide 893 (the *number* of men) by 47 (the *umber* in Front) the Quotient will be 19 File in depth; he Work followeth;

47) 893 (19 *deep in file*

47

423
423

(0)

Queſt. 6. There is a *Table* whoſe Superficial content s 72 feet, and the breadth of it at the end is 3 feet, ow I demand what is the length of this Table? *Facit* 4 feet long; for if you divide 72 (the content of he Table in feet) by 3 (the breadth of it) the Quo- ient is 24 feet for the length thereof, which was re- uired. See the Operation as followeth;

3) 72 (24

6

12
12

(0)

The Proof of Multiplication and Diviſion.

Multiplication and *Diviſion* interchangeably prove ach other; for if you would prove a Sum in *Divi-* on, whether the Operation be right or no, Multiply the *Quotient* by the *Diviſor*; and if any thing remain after the *Diviſion* was ended, add it to the Product, which Product (if your Sum was rightly *divided*) will be equal to the *Dividend*: And contrariwiſe, if you would prove a Sum in *Multiplication*, *divide* the *Product* by the *Multiplyer*, and if the work was rightly performed, the *Quotient* will be equal to the Multiplicand. See the Example where the Work is done and undone: Let 7654 be given to be multiplyed by 3242, the Product will be 24814268 as by the Work appeareth.

```
       7654
       3242
     ------
      15308
     30616
    15308
   22962
   --------
   24814268
```

And then if you *divide* the ſaid *Product* 24814268 by 3242 the *Multiplyer*, the *Quotient* will be 7654 equal to the given Multiplicand.

```
3242)24814268(7654
         ....
     22694
     -----
      21202
      19452
      -----
       17506
       16210
       -----
        12968
        12968
        -----
         (0)
```

In like manner (to prove a Sum or Number in *Di-* *iſion*) If 24814268 were *divided* by 3242 the Quotient will be found to be 7654; then for proof, if ou multiply 7654 the Quotient by 3254 the *Diviſor*, e Product will amonnt to 24814268, equal to the *ividend.*

Or you may prove the laſt or any other Example in *ultiplication* thus, *viz.* *Divide* the Product by the Multiplicand, and the Quotient will be equal to the Multiplyer. See the Work.

```
         7654
         3242
        ------
        15308
       30616
      15308
     22962
    ----------
7654)24814268(3242
     ....
     22962
    ------
     18522
     15308
    ------
      32146
      30616
     ------
       15308
       15308
      ------
        (0)
```

From whence there ariſeth this Corollary, that any)peration in *Diviſion* may be proved by *Diviſion*; for f after your *Diviſion* is ended, you divide the *dividend* y the Quotient, the new Quotient thence ariſing will be equal to the *Diviſor* of the firſt operation; for tryal whereof let the laſt Example be again repeated.

3242

```
3242) 24814268 (7654
         ....
      22694
      -----
       21202
       19452
       -----
        17506
        16210
        -----
         12968
         12968
         -----
          (0)
```

For Proof whereof divide again 24814268 by th Quotient 7654, and the Quotient hence will be equa to the firſt *Diviſor* 3242 ; ſee the Work.

```
7654) 24814268 (3242
          ....
       22962
       -----
        18522
        15308
        -----
        32146
        30616
        -----
         15308
         15308
         -----
          (0)
```

But in proving *Diviſion* by *Diviſion*, the Learner is t obſerve this following Caution, that if after his *Diviſion* is ended there be any Remainder, before you g about to prove your Work, ſubtract that Remainde out of our Dividend, and then work as before, as i the following Example, where it is required to divid 43876 by by 765, the Quotient here is 57, and the remainder is 271; ſee thee Work following.

765

765) 43876 (57
· ·
3825

5626
5355

(271)

Now to prove this Work ſubſtract the Remainder 1 out of the *Dividend* 43876 and there remaineth 605 for a new *dividend* to be divided by the former otient 57, and the quotient thence ariſing is 765 ual to the given *Diviſor*, which proveth the Opera- n to be right.

43876
271

57) 43605 (765
· · ·
399

370
342

285
285

(0)

Thus have we gone through the four Species of ithmetick, *viz*. Addition, ſtraction, Multiplicati- , and Diviſion; upon ich all the following les and all other Opera- ns whatſoever that are ſſible to be wrought by Numbers have their imme- te dependance, and by them are reſolved. There- e before the Learner make a further ſtep in this Art, him be well acquainted with what hath been deli- ed in the foregoing Chapters.

Hæ ſunt igitur quatuor illæ ſpecies Arithmetices per quas omnia quæcunque deinceps dicenda ſunt vel quæ per numeros fieri poſſibile eſt, abſolvuntur. Quare eas quiſquis es ante omnia perdiſces. Gem. Friſ. Arith. par. 1

CHAP.

CHAP. VIII.

Of Reduction.

1. REduction is that which brings together 2 or more numbers of different denominations into one denomination; or it ſerveth to change or alter Numbers, Money, Weight, Meaſure of Time, from one denomination to another; and likewiſe to abridge Fractions to their loweſt *Terms*. All which it doth ſo preciſely, that the firſt *Proportion* remaineth without the leaſt jot of *Error* or *VVrong* committed. So that it belongeth as well to *Fractions* as *Integers*, of which in its proper place. *Reduction* is generally performed either by Multiplication or Diviſion; from whence we may gather, that,

Hills Arith. Ch.13.152.

2. *Reduction* is either Deſcending or Aſcending.

3. *Reduction* Deſcending, is when it is required to *reduce* a *Sum* or *Number* of a greater Denomination into a leſſer; which *Number*, when it is ſo reduced ſhall be equal in value to the *number* firſt given in th greater Denomination; as if it were re quired to know how many *ſhillings, pence* or *farthings* are equal in value to an *hun dred pounds*? or how many *ounces* are con tained in 45 *hundred weight*; or how many *days, hours* or *minutes* there are in 240 *Years, &c.* And this kind of *Reduction* generally performed by Multiplication

Wing. Arith. ch. 7.2,3,4.

4. *Reduction* is Aſcending, is when it is Required t *Reduce* or *Bring* a *Sum* or *Number* of a ſmaller Denomi nation into a greater, which ſhall be equivalent to th given *number*; as ſuppoſe it were required to fin out how many Pence, Shillings or Pounds are equa in value to 43785 *Farthings*; or how many *Hundrea* are equal to (or in) 3748 *pounds, &c.* and this kind *Reduction* is always performed by *Diviſion*.

5. When a *Sum* or *Number* is given to be *reduc* into another Denomination, you are to conſider wh

th

her it ought to be reſolved by the Rule deſcending or ſcending, *viz.* by Multiplication or Diviſion : If it e to be performed by Multiplication, conſider how nany parts of the Denomination into which you vould reduce it, are contained in a *Unit* or *Integer* of he given *Number*, and multiply the ſaid given *number* hereby,and the product thereof will be the Anſwer to he Queſtion. As if the Queſtion were in 8 *pounds*, how many *ſhillings*? Here I onſider, that in one *pound* are 20 *ſhillings*, nd that the number of *ſhillings* in 38 *pounds* vill be 20 times 38, where I multiply 8 *l.* by 20, and that product is 760, and ſo nany *ſhillings* are contained in 38 *pounds*, as in the largent.

38
20
——
760

But when there is a Denomination, or Denominaions between the *Number* given, and the *Number* reuired, you may (if you pleaſe) reduce it into the ext inferiour Denomination, and then into the next ower than that, &c. until you ave brought it into the Denoination required : As for Exnple, let it be demanded in 32 *pounds* how many *farthings*? irſt, I multiply 132 (the *Num*r of *pounds* given by 20 to ing it into *ſhillings*) and it akes 2640 *ſhillings*, then do I ultiply the *ſhillings* (2640) by 2, to bring them into *pence*, d it produceth 31680, and ſo any *pence* are contained in 2640 *llings*, or 132 *pounds*; then do I ultiply the *pence*, *viz.* 31680 4 to bring them into *farthings* (becauſe 4 *farthings* a *penny*) and I find the *product* thereof to be 126720, d ſo many *farthings* are in equal value to 132 *pounds*, e Work is manifeſt in the *Margent*.

132 *pounds*
20
——
2640 *ſhill.*
12
——
5280
2640
——
31680 *pence*
4
——
126720 *farth.*

6. And if the *number* propounded to be reduced, to be divided, or wrought by the Rule Aſcending,

conſider how many of the given *numbers* are equal to an *Unit* or *Integer*, in that denomination to which you would *reduce* your given *number*, and make that your *Diviſor* : and the given *number* your D*ividend* ; and the *Quotient* thence *ariſing* will be the *number* ſought or required*:* As for Example, Let it be required to reduce 2640 *ſhillings* into *pounds*, here I conſider that 20 *ſhillings* are equal to one pound, wherefore I divide 2640 (the given *Number*) by 20, and the *Quotient* is 132, and ſo many *pounds* are contained in 2640 *ſhillings*. In Reduction deſcending and aſcending the Learner is adviſed to take particular notice of the Tables delivered in the ſecond Chapter of this Book, where he may be informed what *Multipliers* or *Diviſors* to make uſe of in the reducing of any Number to any other Denomination whatſoever, eſpeciall *Engliſh* Moneys, Weights, Meaſures, Time and Motion but in this place it is not convenient to meddle wit Foreign Coyns, Weights, or Meaſures.

```
         l.
2|0)264|0(13
      ...
       2
      ---
       6
       6
      ---
        4
        4
      ---
       (0)
```

But if in Reduction Aſcending it happen that ther is a denomination or denominations between the *num* *ber* given, and the *number* required, then you may *r* *duce* your *number* given into the next *ſuperiour* denom nation, and when it is ſo reduced, bring it into th next above that, and ſo on until you have brought into the Denomination required. As for Example,

Let it be demanded in 126720 *farthings* how ma *pounds*? Firſt, I divide my given *number* (being *fa* *things*) by 4, to bring them into *pence*, (becauſe 4 *fa* *things* make one *penny*, and they are 31680 *pence*, th I devide 31680 *pence* by 12, and the *Quotient* give 2640 *ſhillings*, and then I divide 2640 *ſhillings* by 2 and the *quotient* giveth 132 *pounds*, which are equal value to 126720 *farthings*. See the whole Work it followeth.

```
                  12)        20)        l.
4) (126720   (31680    (264|0    (132
    ......      ...       ..
    12          24        2
    ---         ---       ---
     6          76        6
     4          72        6
    ---         ---       ---
    27          48        4
    24          48        4
    ---         ---       ---
     32         (0)       (0)
     32
    ---
    (0)
```

7. When the *number* given to be reduced, conſiſteth
divers denominations, as *pounds*, *ſhillings*, *pence* and
rthings,or of *hundreds*, *quarters*,*pounds* and *ounces*, &c.
en you are to reduce the higheſt (or greateſt) deno-
nation into the next *Inferiour*,and add thereunto the
nber ſtanding in that denomination which your grea-
ſt or higheſt *number* is reduced to ; then reduce that
m into the next *Inferiour* Denomination, adding
ereto the *number* ſtanding in that denomination ; do
until you have brought the *number* given into the
nomination propoſed. As if it were required to
duce 48 *l.* 13 *s.* 4 *d* into *pence* ; firſt, I bring 48 *l.*
o *ſhillings*, by multiplying it by 20, and the *product*
960 *ſhillings*, to which I add the 13 *ſhillings*, and
ey make 973, then I multiply 973 by 12, to bring
e *ſhillings* into *pence*, and they make 11676 *pence*, to
ich I add the 10 *pence*, and they make 11686 *pence*
the Anſwer, ſee the Work done.

48 *l.*

l. *s.* *d.*
48—13—10
20

960 *ſhillings*
Add 13
Sum 973 *ſhillings*
12

1946
973

11676 *pence*
Add 10

Sum 11686 *pence*

8. If (in Reduction Aſcending) after Diviſion i ended, any thing remain, ſuch Remainder is of th ſame Denomination with the Dividend.

Example. In 4783 *farth.* I demand how many *pound*

Firſt, I divide the given *number* of *Farthings*, (*viz* 4783) by 4 to bring them into *pence*, and the Quo tient is 1195 *pence*, and there remaineth 3 after th work of Diviſion is ended, which is 3 *farthings.*

Again, I divide 1195 *pence* (the ſaid *Quotient*) by 1 to reduce them into *ſhillings*, and the *Quotient* is 9 *ſhillings*, and there is a Remainder of 7, which is *pence.*

And then I divide 99 *ſhillings* (the laſt *Quotient*) b 20, to bring it into *pounds*, and the *Quotient* is 4 *l.* a there remaineth 19 *ſhillings*; ſo that I conclude th in 4783 (the propoſed *number* of *farthings*) there is *pounds*, 19 *ſhillings*, 7 *pence*, 3 *farthings*, view the fo lowing Operation.

12 2|0) (4 *pounds*
4) 4783 (1195 9|9
4 108 8|
07 115 (19) *ſhillings*
4 108
38 Rem. (7) *pence*
36
l. s. d qrs.
23 *facit* 04—19—07—03
20

Remains (3) *farthings*

More Examples in Reduction of Coin.

Queſt. 1. In 438 *l.* how many *ſhillings?* *Facit* 8760 *lings*, for by multiplying 438 by 20, the *Product* ounteth to ſo much. See the Work.

438 *pounds*
20

Facit 8760 *ſhillings*

Queſt. 2. In 467 *l.* how many *Pence?* Firſt, multi- the given *number* of *pounds* (467) by 20 to bring it o ſhillings, and it makes 9340 *ſhillings*, then multi- the *ſhillings* by 12, and it produceth 112080 *pence*, s,

467 *pounds*
20 *ſhillings*

9340 *ſhillings*
12

18680
9340

Facit 112080 *pence*

Or it may be reſolved thus, *viz.* multiply the give *number* of *pounds* (467) by (240) the *number* of *pen* in a *pound*, and the Product is the ſame, *viz.* 11208 *pence*, as by the Operation appeareth.

467 *pounds*
240
18680
934
Facit 112080 *pence*

Queſt. 3. In 5673 *l.* how many *farthings*? Fir Multiply the given *number* by 20, to bring it in *ſhillings*, and it produceth 113460 *ſhillings*, then m tiply that *product* by 12, to bring it into *pence*, and produceth 1361520 *pence*; then laſtly, multiply *pence* by 4, and it produceth 5446080 *farthings*. the Operation.

5673 *pounds*
20
113460 *ſhillings*
12
226920
113460
1361520 *pence*
4
Facit 5446080 *farthings*

Or this Queſtion might have been thus reſo *viz.* Multiply 5673 (the given *number* of *pounds* 960 (the *number* of *farthings* in a *pound*) and it pr ceth the ſame Effect, as you may ſee by the Wor

5673 *pounds*
960
340380
51057
it 5446080 *farthings*

20 *ſhillings*
12
240 *pence*
4
960 *farthings*

Otherwiſe thus; Firſt bring the given *number* 5673*l.*
o *ſhillings*, and multiply the *ſhillings* by 48, the
ber of *farthings* in a *ſhilling*, and the ſame Effect is
reby likewiſe produced, *viz.*

5673 *pounds*
20
113460 *ſhillings*
48
907680
543840
Facit 5446080 *farthings*

12 *pence*
4
48 *farth.*

hese various ways of Operating are expreſſed to in-
n the Judgment of the Learner, with the Reaſon of
Rule; more ways may be ſhown, but theſe are ſuffi-
nt even for the meaneſts Capacities.

Queſt. 4. In 458 *l.* 16 *s.* 7 *d.* 3 *qrs.* how many *far-*
gs? To Reſolve this Queſtion conſider the ſeventh
e of this Chapter, and work as you are there di-
ted, and you will find the aforeſaid given *number*
mount to 440479 *farthings*, *viz.*

l. s. d qrs.
458—16—07—3
20

9160 *ſhillings*
Add 16

Sum 9176 *ſhillings*
12

18352
9176

110112 *pence*
Add 07

Sum 11019 *pence*
4

440476 *farthings*
Add 3

Sum 440479 *farthings.*

This laſt Queſtion (or any other of this kind, v
where the *number* given to be reduced conſiſteth of
veral Denominations) may be more conciſely reſolv
thus, *viz.* when you multiply the pounds by 20,
bring them into ſhillings, to the product of the fi
Figure, add the Figure ſtanding in the place of Ur
in the Denomination of ſhillings, but becauſe the f
Figure in the Multiplier is (o) I ſay o times 8 is
thing, but 6 is 6, which I put down for the firſt
gure in the product, then becauſe this Multiplier is
I go on no further with it, for if I ſhould, the wh
Product would be o, but proceed, and when I co
to multiply by the ſecond Figure in the Multiplier,
to the Product of it, I add the Figure ſtanding in
place of Tens in the Denomination of ſhillings wh

1) ſaying 2 times 8 is 16, and (the ſaid Figure) 1
7, then I ſet down 7, and carry an Unit to the Pro
t of the next Figure as is directed in the fifth Rule
he ſixth Chapter foregoing; and finiſh the Work.
hat you now have the whole Product and Sum of
ings at one operation, which is the ſame as before,
when you multiply the ſhillings by 12, to bring
n into pence (after the ſame manner) add to the
duct the number ſtanding in the denomination of
ce, and ſo when you multiply the pence by 4 to
g them into farthings, add to the Product the num-
ſtanding under the denominations of Farthings.
the laſt Queſtion thus wrought.

l. s. d. qrs.
458—16—07—3
20

9176 *ſhillings*
12

18359
9176

110119 *pence*
4

Facit 440479 *farthings.*

fter the Method laſt preſcribed (which if Rightly
ſidered, differeth not any thing from the 7*th* Rule
his Chapter) are all the following Examples that
of the ſame nature wrought and reſolved.

ueſt. 5. In 4375866 Farthings, I demand how ma-
Pounds, Shillings, Pence, and Farthings?

o reſolve this Queſtion; Firſt, I divide the given
ber of Farthings by 4, and the Quotient is 1093966
ce, and there Remaineth 2 after the Diviſion is
ed, (which by the 8*th*. Rule foregoing) is two Far-
gs; then I divide 1093966 Pence by 12 and the

Quotient is 91163 Shillings, and there remaineth 11 after Diviſion, which by the ſaid 8*th.* Rule is ſo man Pence, *viz.* 10 *d.* then I divide 91163 Shillings 20, and the Quotient is 4558 *l.* and there remaine 3 Shillings, ſo the work is finiſhed, and I find that 4375866 Farthings there are 4558 *l.* 03 *s.* 10 *d.* 2 q See the Operation,

```
             12)          2|0         l.
4)  4375866  (1093966  (9116|3   (4558
    .......       .....    ....
    4          101        8
    --         ---        --
    37         13         11
    36         12         10
    --         --         --
     15        19          11
     12        12          10
     --        --          --
      38        76         16
      36        72         16
      --        --         --
       26        46       (03) ſhillings
       24        36
       --        --
       26       (10) pence
       24
       --
     (2) farthings
```

l. s. d. qrs.

Facit 4558——03——10——2

***Queſt* 6. In** 4386 *l.* I demand how many Gro To **Reſolve** this Queſtion, I reduce the given n ber of Pounds into Shillings, and they are 87 Shillings now I conſider that in a Shilling are 3 Gro therefore I multiply the Shillings by 3, and it Pro ceth 263160 Groats. See the Work.

4386 *pounds*
20

87720 *ſhillings*
3

Facit 263160 *groats*

This Queſtion might have been otherwiſe reſolved us, *viz.* conſidering that in a Pound (or 20 ſhillings) re are 3 times 20 Groats, which make 60, by ich I multiply the number of Pounds given, and produceth the ſame Effect at one Operation, as loweth.

4386 *pounds* 20
60 *groats in* 20 *s.* 3

Facit 263160 *groats in* 4386 *l.* 60

Queſt. 7. In 43758 three Pences, I deſire to know w many Pounds?

To reſolve this (and many ſuch like)Queſtions; Firſt, divide my given number of Pences by 4, becauſe three Pences are in a ſhilling, and the Quotient is 9 39 ſhillings, and there remaineth 2 after Diviſion ended, which is 2 three Pences (by the 8*th.* Rule of s Chapter) which are equal in value to 6 *d.* then I vide 10939 Shillings by 20, and the quote giveth 6 *l.* and 19 *s.* Remain; ſo that I conclude in 43758 eces of three pence *per* piece, there are 546 *l.* 19 *s.* *d.* as by the Work appeareth.

2|0 l. s. d.
4) 43758 (1093|9 (546—19—06
• • • • • • •
4 10
37 9
36 8
15 13
12 12
38 19 *ſhillings*
36
(2) *three pences*, or 6 d.

This Queſtion might have been otherwiſe Reſolv
thus, *viz.* firſt multiply the given Number of thr
pences 43758, by three the Number of pence in thr
pence, and the product (*viz.* 131274) is the Numb
of pence equal to the given Number of three pence
which number of pence may be brought into poun
by dividing by 12 and by 20, and the Quotient yo
will find to be equal to the former work, *viz.* 546
19 *s.* 6 *d.*

43758
3
2|0) l. s. d.
12) 131274 (1093|9 (546—19—06
• • • • • • • •
12 10
112 9
108 8
47 13
36 12
114 *rem.* (19) *ſhillings.*
108
Remains (6) *pence*

Or thus, divide the given *Number* of 3 pences by *number* of 3 pences in a pound or 20 ſhillings ich you will find to be 80, if you multiply 20 *s.* 4, the *number* of three pences in a ſhilling) and will find the quote to be 546 *l.* as before, and a mainder of 78 three pences, and if you divide thoſe three pences by 4 (becauſe there are 4 three pen- in a ſhilling) you will find the quote to be 19 *s.* d 2 three pences Remain, which are equal to 6 *d.* ich is the ſame that was before found.

```
                l.   s.  d.
8|0) 4375|8 (546—89—05                20
      ...                              4
     40                               ——
    ————                              80
     37
     32
    ————
      55
     48
    ———— s.
   4) 78 (19
      ..
       4
    ————
      38
      36
     ———
     (2) three pences or 6 d.
```

Queſt. 8. In 4784 *l.* 13 *s.* how many pieces of 13½ *d.* r piece?

This Queſtion cannot be reſolved by Reduction, de-ending, or aſcending, abſolutely, (becauſe 13½ *d.* is o even part of a pound) but rather by them both intly, *viz.* by multiplication and Diviſion; for if you ring the number given into half pence, and divide e half pence, by the half pence, in 13½ *d.* *viz.* 7, the quotient will be the Anſwer; for having brought 4785 *l.* 13 *s.* into half pence, I find it make 2297112, which I divide by 27, (becauſe there ar ſo many half-pence in 13½*d.*) and the quote give 85078 pieces of 13½*d.* and 6 half pence remain ove and above; obſerve the work following.

l. s. — d.
4785—13 — 13½
20 — 2

95713 *ſhilling* — 27 *half-pence*
24 *half-pence in a ſhilling*

382852
191426

2297112 *half-pence in the given number.*

27) 2297112 (85078 *pieces of* 13½ d.
216

137
135

211
189

222
216

Remain (6) *half-pence*

It would have produced the ſame anſwer if yo had reduced your given number into farthings, an divided by the farthings in 13½*d. viz.* 54 (for a ways the Dividend and the Diviſor muſt be of on Denomination) and then you would have had a Re mainder of 12 farthings, which are equal in value t the former Remainder of 6 half-pence, as you ma prove at your leiſure.

Queſt. 99

ueſt. 9. In 540 Dollars at 4 *s.* 4 *d. per* Dollar how y pounds *ſterling* ?

irſt, Bring your given Number of Dollars into ce, and then your Pence into Pounds according to former Directions. Thus in 4 *s.* 4 *d.* (*viz.* a ar) you will find 52 pence, by which multiply Dollars, and it produced 28080 pence, which if divide by 240 (the pence in one pound) the quot will give you 117 *l.* which are equal in value to dollars, at 4 *s.* 4 *d. per* dollar obſerve the Operaon.

```
                                  s.  d.
        540                       4—4
         52                      12
       ————                      ———
       1080                      52 pence
      2700
      —————      l.
24|0) 2808|0 (117
        ...
       24
      ———
       40
       24
      ———
      168
      168
      ———
      (0)
```

e foregoing Queſtion might have been otherwiſe ght, thus, *viz.* Multiply (540) your given numf Dollars, by 13 the number of Groats in a Dolor 4 *s.* 4 *d.*) and it produceth 7020 groats, which e by 60 (the groats in 1 pound or 20 ſhillings) the quote is 117 *l.* as before. See the Work.

```
                   s.  d.
   540             4--4
    13             3
  ----            ----
  1620            13
  540
6|0)702|0(117
   6
  ---
   10
    6
  ---
   42
   42
  ---
   (0)
```

Queſt. 10. In 547386 pieces of 4½*d. per* piece demand how many Pounds, Shillings, and Pence?

Firſt, Bring your given number of four pence ha penies all into half-pence, which you will do if y multiply by 9 the number of half-pence in 4½*d.* a the product is 4926474 half-pence, which are broug into pounds, if you divide them by 24 (the ha pence in a ſhilling) and 20 (the ſhillings in a poun t makes 10263 *l.* 09 *s.* 9 *d.* as by the Work.

```
                                                d.
   547385                                       4½
        9                                        2
   ------                                       ---
             2|0)        l.                      9 half-pence
24) 4926474 (20526|9 (10263
    .......  .....
     48          2
    ----       ----
    126         05
    122          4
    ----       ----
     64         12          l.      s.    d.
     48         12 facit  10263—09—09
    ----       ----
    167          6
    144          6
    ----       ----
    234 rem. (09) ſhillings
    216
    ----
Rem. (18) half-pence or 9 d.
```

Queſt. 11. In 4386 *l.* I demand how many pieces of
d. of 4 *d.* and of 2 *d.* of each an equal Number ?
ut is to ſay, what Number of Six-pences, Groats, and
o pences, will make up 4386 *l.* and the Number of
ch equal ?

The way to reſolve queſtions of this Nature, is to
d the ſeveral pieces (into which the given Number
to be brought) into one Sum, and to reduce the gi-
n Number into the ſame denomination with their
m, and to divide the ſaid given Number (ſo Redu-
d) by the ſaid Sum, and the Quotient will give you
e exact Number of each piece. And after the ſame
ethod will we proceed to Reſolve the preſent Que-
on, *viz.*

4386 *l.*

6
4
2
Sum 12 *pence*

4386 *pounds*
240 *pence*

175440
8772

12) 1052640 (87720
96

92
84

d. d. d.
86 *facit* 87720 *pieces of* 6—4—2
84

24
24

(0)

So that I conclude by the operation that 87720 ſi pences, and 87720 groats, and 87720 two pences a juſt as much as (or equal to) 4386 *l.* or if you adm of 5 *s.* to be thus divided, it is equal to 5 ſix pence and 5 four pences or Groats, and 5 two pences. *For two Right lines (or two Numbers) be given, and one them be divided into as many Parts, or Segments as y pleaſe, the Rectangle (or Product) comprehended under t two whole Right lines (or numbers given) ſhall be equal all the Rectangles (or Products) contained under the who line (or Number) and the ſeveral Segments (or Parts) in which the other line (or Number) is divided*, Eucl. 2.

Another Queſtion of the ſame Nature with tl laſt may be this following, *viz.*

Queſt. 12. A Merchant is deſirous to Change 148 into pieces of 13*d.*$\frac{1}{2}$ of 12 *d.* of 9 *d.* of 6 *d.* ar of 4 *d*; and he will have of each ſort an equal Nun ber of pieces, I deſire to know the number?

Do as you were taught in the laſt queſtion, *v.* add the ſeveral pieces together, and reduce the Su

int

into half-pence, then reduce the Sum to be changed, *viz.* 148 *l.* into the ſame denomination, and divide the greater by the leſſer, and in the Quotient you will find the Anſwer, *viz.* 798 is the Number of each of the pieces required, and, 18 remaineth, which is 18 half-pence by the 8*th.* Rule of this Chapter. See the Work as followeth.

l.	d.
148	$13\frac{1}{2}$
240 *pence in a* l.	12
	9
5920	6
296	4
35520 *pence in* 148 l.	*Sum* 44
2	$2\frac{1}{2}$
71040 *half-pence*	89 *half-pence*

89) 71040 (798 *pieces of each ſort*

623

874
801

730
712

Remain (18) *half-pence*

The truth of the two foregoing Operations will thus be proved, *viz.* multiply the Anſwer by the parts, or pieces into which the given Number was reduced, and having added the ſeveral Products together, if their Sum be equal to the given Number, the Anſwer is Right, otherwiſe not.

So the Anſwer to the 11*th.* Queſtion was 87720, which is proved as followeth, *viz.*

87720

l.
87720 { *Six-pences make* 2193
Four-pences make 1462
Two-pences make 731

The total Sum of them 4386 *which wa*
the Sum given to be changed.

The Anſwer to the 12*th*. Queſtion was 798, and 18 half-pence remained after the Work was ended, now the truth of the work may be proved as the former was, *viz.*

l. s. d.
798 { *Pieces of* 13½ *make*——44—17—09
Pieces of 12 *make*——39—18—00
Pieces of 9 *make*——29—18—06
Pieces of 6 *make*——19—19—00
Pieces of 4 *make*——13—06—00
and 18 *half-pence, or* 9 d. *remains*——00—00—09

The Total Sum of them 148—00—09

which Total Sum is equal to the Number that was firſt given to be changed, and therefore the Operation was rightly performed.

Reduction of Troy-weight.

We come now to give the Learner ſome Example in *Troy-weight*, wherein we ſhall be brief, having given ſo large a Taſte of *Reduction* in the foregoing Examples of Coyn, and now the Learner muſt be mindfu of the Table of *Troy-weight* delivered in the ſecon Chapter of this Book.

Queſt. 13. In 482 *l.* 07 *oz.* 13 *p.w.* 21 *gr.* how many Grains?

Multiply by 12, by 20, and by 24, taking in the Figures ſtanding in the ſeveral denominations, according to the Direction given in the 7*th*. Rule of thi Chapter, and you will find the Product to be 278001 Grains, which is the Number required, or Anſwer t the Queſtion. See the whole work as followeth.

```
     l.   oz.  p.w.  gr.
    482—07—13—21
       12
    ------
      971
     482
    ------
     5791 ounces
       20
   -------
   115833 penny weight
       24
   -------
   463333
  231668
  -------
```

Facit 2780013 *grains*.

Queſt. 14. In 2780013 *grains*, I demand how many Pounds, Ounces Penny-Weights, and Grains?

This is but the foregoing Queſtion inverted, and is reſolved by dividing 24 by 20, and by 12, and the Anſwer is 482 *l.* 07 *oz.* 13 *p.w.* 21 *gr.*

```
                     2|0)          12)     l.
 24)  2780013   (11583|3   (5791  (482
       .....       ....       ...
      24           10          48
     ----         ----        ----
       38          15          99
       24          14          96
     ----         ----        ----
      140          18          31
      120          18          24
     ----         ----        ----
       200          3 Rem.    (7) ounces.
       192          2
      ----        ----
          81 Rem. (13 penny-weight
          72
         ----
          93              l.   oz.  p.w.  gr.
          72  facit     482—07—19—21
Remain   (18) grains
```

*Queſt.*15. A Merchant ſent to a Goldſmith 15 Ingots of Silver each containing in weight 2 *l.* 4 *oz.* and ordered it to be made into Bowls of 2 *l.* 8 *oz. per* Bowl, and Tankards of 1 *l.* 6 *oz. per* piece, and Salts of 10 *oz.* 10 *p.w. per* Salt, and Spoons of 1 *oz.* 18 *p.w. per* Spoon; and of each an equal number, I deſire to know how many of each ſort he muſt make?

This queſtion is of the ſame Nature with the 11 and 12 queſtions foregoing, and may be anſwered after the ſame Method, *viz.* Firſt, add the weight of the ſeveral Veſſels (into which the Silver is to be made) into one Sum, and reduce it to one Denomination, and they make 1248 *penny weights*, then reduce the weight of the Ingot into the ſame denomination, *viz. penny weights*, (and it makes 560 *penny weights*) and multiply them by the Number of Ingots, *viz.* 16, and the product will give you the weight of the 16 Ingots, *viz.* 8960, then divide this product by the weight of the Veſſels, *viz.* 1248, and the Quotient giveth you the Anſwer to the Queſtion, *viz.* 7. and 224 *p.w.* remaining over and above.

l. *oz.*
2——4
12
——
28
20
——
560 *penny weights*
16 *Ingots*
——
3360
560
——
1248) 8960 (7 *Veſſels of each*
8736
——
Rem. (224) *penny weights*

l. *oz* *p.w*
2—08—00
1—06—00
0—10—10
0—01—18
——
Sum 5—02—08
12
——
62
20
——
1248 *p.weights*

The Proof of the Work is as followeth, viz.

	l. *oz.* *p.w.*
Bowls of 2—08—00 *per Bowl is*	18—08—00
Tank. of 1—06—00 *per Tank. is*	10—06—00
Salts of 0—10—10 *per Salt is*	06—01—10
Spoons of 0—01—18 *per Spoon is*	01—11—04
224 *penny weight remaining is*	00—11—04
Total Sum	37—04—00

So that you ſee the Sum of the Weights of each
eſſel, together with the Remainder is 37 *l.* 4 *oz.*
hich is equal to the Weight of the 16 Ingots delive-
d. For if 37 *l.* 04 *oz.* be reduced to Penny Weights,
makes 8960.

Reduction of Averdupois Weight.

In Reducing *Averdupois Weight*, the Learner muſt
ve Recourſe to the Table of *Averdupois weight* deli-
red in the 2*d.* Chapter foregoing.

Queſt. 16. In 47 *C.* 1 *qr.* 20 *l.* how many Ounces?
ltiply by 4, by 28, and by 16, and the laſt Pro-
ct will be the Anſwer, *viz.* 84992 Ounces.

C. *qrs.* *l.*
47—1—20
4

189 *quarters*
28

1512
380

5312 *l.*
16

31872
5312

Facit 84992 *ounces*

Queſt. 17. In 84992 Ounces, I demand how man
C. qrs. l. oz.

This is the foregoing Queſtion Inverted, and wi
be Reſolved if you divide by 16, by 28, and by
and the Anſwer is 47 *C.* 1 *qr.* 20 *l.* equal to the give
Numbers in the foregoing Queſtion.

```
                 28)      4)     C.  qrs.  l.  oz.
16)  84992   (5312   (189   (47—1—20—00
      ....     ...
      80        28      16
      ——        ——      ——
      49       251      29
      48       224      28
      ——       ———      ——
       19      272     (1) quarter
       16      252
       ——      ———
       32     (20) pounds
       32
       ——
       (0)
```

Queſt. 18. A Chapman buyeth of a Grocer 4*C.* 1
14*l.* of Pepper, and ordered it to be made up in
Parcels of 14 *l.* of 12 *l.* of 8 *l.* of 6 *l.* and of 2 *l.* an
of each Parcel an equal number, now I would kno
the number of each parcel.

This Example is of the ſame nature with the 1
and 12, and 15 Queſtions foregoing, and after t
ſame manner is reſolved. See the Operation as f
loweth.

C. *qrs.* *l.*
4——1——14
4

17
28

140
35

42)490(11

42

70 *Facit* 11 *of parcels of each*
42

Rem. (28) *pounds*

l.
14
12
8
6
2

42 *pounds*

Reduction Liquid Meaſure.

Queſt. 19. In 45 *Tun* of Wine, how many *Gallons* ? Multiply by 4, and by 63 the product is 11350 Gal-
is for the Anſwer.

45
4

180
63

540
1080

Facit 11340 *gallons*

Queſt. 20. In 43 Rundlets of Wine, each containing Gallons, I demand how many Hogſheads ?
Firſt, Find how many Gallons is in the 34 Rundlets, ich you may do if you multiply 34 by 18, the con- nt of a Rundlet, and the Product is 612 Gallons, which

which you may reduce into Hogſheads if you divide them by 63, and the Quote will be 9 Hogſheads, an 45 Gallons. See the Work.

34
18

272
34

63) 612) 9 *Hhds.*
•
567

Remain (45) *gallons*
facit 9 *Hhds* 45 *gallon*

Queſt. 21. In 12 Tun how many Runlets of 1 Gallons *per* Runlet ?

Reduce your Tuns into Gallons, and divide them b 14, the Gallons in a Runlet, and the Quotient (21 is your Anſwer. See the Work following.

12
4

48
63

144
288

14) 3024 (216 *rundl.*
• • •
28

28
14

84
84
(0) *facit* 216 *runlets*

Reduction of Long Meaſure.

Queſt. 22. I demand how many Fulongs, Poles, In-
es and Barley Corns will reach from *London* to *York*, being accounted an 151 Miles?

151 *miles*

8 *furlongs in a mile*

1202 *furlongs*

40 *poles in a furlong*

48320 *poles*

11 *half yards*

48320

48320

531520 *half yards*

18 *inches in half a yard*

4252160

531520

9567360 *inches*

3 *barley corns in an inch*

Facit 28702080 *barley corns in* 151 *miles*

Queſt. 23. The Circumference of the Earth (as all
her Circles are) is divided into 360 Degrees, and
ch degree into 60 Minutes, which (upon the Super-
ies of the Earth) are equal to 60 miles; now I de-
and how many Miles, Furlongs, Perches, Yards,
et, and Barly-Corns will reach round the Globe of
e Earth?

360	*degrees*
60	*minutes or miles in a degree*
21600	*miles about the Earth*
8	*furlongs in a mile*
172800	*furlongs about the Earth*
40	*perches in a furlong*
6912000	*poles or perches about the Earth*
11	*half yards in a perch*
6912000	
6912000	
2) 76032000	*half yards about the Earth*
(38016000	*yards,* viz. *the half yards*
3	*divided by* 2.
114048000	*feet about the Earth*
12	*inches in a foot*
228096000	
114048000	
1368576000	*inches about the Earth*
3	*barly-corns in an inch*
facit 4105728000	*barly-corns*

And ſo many will reach round the World,the who being 21600 Miles, ſo that if any Perſon were to g Round, and go 15 Miles every Day, he would go th whole Circumference in 1440 Days which is 3 Year 11 Months, and 15 Days.

Reduction of Time.

Queſt. 24. In 28 Years, 24 Weeks, 4 Days, 16 Hours,
Minutes, how many Minutes?

years *weeks* *days* *hours* *min.*
28 24 4 16 30
52 *Weeks in a year.*

60
142

1489 *Weeks*
7

10364 *Days*
24

41462
20729

248752 *Hours*
60

14925150 *minutes*

ote, That in Reſolving the laſt Queſtion after the
hod expreſſed , there is loſt in every year 30
rs, for the Year conſiſteth of 365 Days and 6
rs, but by multiplying the Years by 52 Weeks,
ch is but 364 Days ; You loſe 1 Day and 6 Hours
y Year, wherefore to find an exact Anſwer,
g the odd Weeks, Days, and Hours into Hours,
then multiply the Years by the Number of Hours
Year, *viz.* 8766, and to the Product add the
rs contained in the odd time, and you have the
t time in hours, which bring into Minutes as be-
. See the laſt Queſtion thus reſolved.

weeks days hours
24—4—16
7

172
24

694
345

4144 *hours*

days, hours
365—6
24

1466
730

8760 *hours in a year*

28
8766

172
172
197
228

249592 *hours*
60

14975510 *Minutes in* 28 *years and* 4144 *hou*

So you ſee that according to the Method firſt uſ to reſolve this Queſtion, the Hours contained in t given time are 248752,but according to the laſt,be or true Method, they are 249592 which exceeds t former by 840 hours.

But for moſt occaſions it will be ſufficient to m tiply the given years by 365, and to the Product a the days in the odd time, if there be any, and th there will be only a loſs of 6 hours in every ye which may be ſupplied by taking a fourth part of t given years, and adding it to the contained days,a you have your deſire.

Queſt. 25. In 438657540 Minutes,how many ye *Facit* 834 *years,* 4 *days,* 19 *hours.*

8766) *yea.* *days* *hou.*
) 43865754|0 (7310959 (834——4——19

42 70128

18 29815
18 26298

6 35179
6 35064 *days*

57 24) 115 (4
54

96

35
30 *Rem.* (19) *hours*

54
54

(0)

ueſt. 26. I deſire to know how many hours and utes it is ſince the Birth of our Saviour Jeſus Chriſt his preſent year, being accounted 1677 years? his Queſtion is of the ſame nature with the 24*th*. going and after the ſame manner is reſolved, *viz*, tiply the given number of years by 8766, the pro- is 14700582 hours, and that by 60, and the pro- is 882034920 Minutes. See the work.

1677 *years*
8766 *hours in a year*

10062
10062
11739
13416

14700582 *hours in* 1677
60

882034920 *minutes* in 1677 *years*

F Note

Note that as Multiplication and Diviſion do int
changeably prove each other, ſo Reduction Deſcend
and Aſcending, prove each other by Inverting
Queſtion, as the 13 and 14, and likewiſe the 16
17 Queſtions foregoing, by Inverſion, do in
changeably prove each other, the like may be
formed for the proof of any Queſtion in Reduct
whatſoever.

Thus far have we diſcourſed concerning ſingle Ari
metick, whoſe Nature and Parts are defined in
ſecond, eighth, ninth, and tenth definitions of
third Chapter of this Book, for although Reductio
not reckoned or defined among the parts of ſi
Arithmetick, yet conſidered Abſtractly, it is the pr
effect of Multiplication and Diviſion; and as for
extraction of Roots (which ought to be handle
the next place as parts of ſingle Arithmetick) we
omit it in this place, and refer the Learner to Mr. Co
Decimal Arithmetick, which is (with great care
pains) now publiſhed, together with his Logarit
tical Arithmetick, ſhewing the Geneſis or Fa
of the Logarithms, and their general uſes in A
metick, &c. As alſo his Algebraical Arithmetick,
taining the Doctrine of compoſing and reſolvin
Equation, with all other Rules neceſſary for th
derſtanding of that Myſterious Art, &c.

CHAP. IX.

Of Comparative Arithmetick, viz. *The tion of* Numbers *one to another.*

1. Comparative Arithmetick is that wh
wrought by Numbers, as they
are conſidered to have relation one to
another, and this conſiſts either in
Quantity, or in Quality.

Boetius lib. 1. c

2. R

2. *Relation* of Numbers in Quantity, is the *Refe-*
nce or *Reſpect*, that the Numbers
mſelves have one to another,
ere the Terms or Numbers pro-
unded are always two, the firſt
led the Antecedent, and the other the Conſequent.

Vide Wing. Arith. cap. 34.

3. The *Relation* of Numbers in Quantity conſiſts in
Differences, or in the rate or reaſon that is found
twixt the Terms propounded, the difference of two
mbers being the *Remainder* found
Subſtraction, but the rate or reaſon
twixt two Numbers is the Quotient
the Antecedent divided by the Con-
uent. So 21 and 7 being given,
difference betwixt them will be found to be 14,
t the rate or reaſon that is betwixt 21 and 7 will be
nd to be triple reaſon, for 21 divided by 7 quotes
the reaſon or rate.

Alſted. Mathemat.lib. 2. *cap*. 11. & 12.

4. The relation of Numbers in Quality, (otherwiſe
led Proportion) is the *Reference* or *Reſpect* that
Reaſon of Numbers have one unto another; there-
the Terms given, ought to be more
n two. Now this Proportion or
aſon between Numbers relating one
another, is either Arithmetical, or
ometrical.

Alſted Math. lib. 2 *cap.* 21.

5. Arithmetical Proportion (by ſome called Pro-
ſſion) is when divers Numbers differ one from ano-
r by equal *Reaſon*, that is, have equal differences.
this *Rank* of Numbers 3, 5, 7, 9, 11, 13, 15, 17,
er by equal *Reaſon*, *viz.* by 2 as you may prove.

2. In a *Rank* of Numbers that differ by Arithmeti-
Porportion, the ſum of the firſt and laſt term be-
multiplyed by half the Number of Terms, the pro-
t is the total ſum of all the Terms.

r if you multiply the number of the Terms by the
ſum of the firſt and laſt Terms, the product
eof will be the total ſum of all the Terms.

o in the former Progreſſion given, 3 and 17 is 20,
ich multiplyed by 4 (*viz.* half the number of Terms)

the product gives 80, the ſum of all the Terms ; multiply 8 (the Number of Terms) by 10 (half t ſum of the firſt and laſt Terms) the product gives as before.

So alſo 21, 18, 15, 12, 9, 6, 3, being given, t ſum of all the Terms will be found to be 84 ; for h the Number of Terms is 7, and the ſum of the fi and laſt (*viz.* 21 and 3) is 24, half whereof, (*viz.* multiplyed by 7 produceth 84, the ſum of the Ter ſought.

7. Three Numbers that differ by Arithmetical P portion, the double of the mean (or middle numb is equal to the ſum of the Extreams.

So 9, 12, and 15 being given, the double of mean 12 (*viz.* 24) is equal to the ſum of the Extre 9 and 15.

8. Four Numbers that differ by Arithmetical P portion (either continued or interrupted) the ſum the two Means is equal to the ſum of the two treams.

So 9, 12, 18, 21, being given, the ſum of 12 and 18 will be equal to the ſum of 9 and 21, *viz.* 30 ; alſo 6, 8, 14, 16, being given, the ſum of 8 and 14, is equal to the ſum of 6 and 16, *viz.* 22, *&c.*

Vide Wing: rith. cap.

9. Geometrical Proportion (by ſome called Geo trical Progreſſion) is when divers numbers diffe cording to like Reaſon.

So 1, 2, 4, 8, 16, 32, 64, *&c.* differ by double ſon, and 3, 9, 27, 81, 243, 729, differ by triple ſon, 4, 16, 64, 256, *&c.* differ by quadruple ſon, *&c.*

10. In any numbers that increaſe by Geome proportion, if you multiply the laſt Term by the tient of any one of the terms divided by anoth the Terms, which being leſs is next unto it, and h deducted, or ſubſtracted, the firſt Term out of Product, divide the remainder by a number that unit leſs than the ſaid Quotient, the laſt quot give the ſum of all the Terms.

p, 1, 2, 4, 8, 16, 32, 64, being
n, firſt I take one of the Terms,
8, and divide it by the Term
ch is leſs and next to it, (*viz.*
4) and the Quotient is 2, by
ch I multiply the laſt term 64,
the product is 128, from whence
bſtract the firſt term (*viz.* 1.)
Remainder is 127, which divided by the Quotient
ade leſs by 1 (*viz.* 1.) the quote is 127, for the ſum
l the given *terms*, as by the Work in the Margent.

64
4) 8 (2
128
1
1) 127 (127

o if 4, 16, 64, 256, 1024, were given, the ſum
l the *terms* will be found to be
4. For firſt, I divide 64 one of
terms by his next leſſer term,
the Quotient is 4, by which I
tiply the laſt term 1024, and it
duceth 4096; from whence I
tract the firſt term 4, and the
ainder is 4092, which I divide
he quote leſs 1 (*viz.* 3.) and the
te is 1364, for the total ſum of all the Terms, as
Margent.

1024
16) 64 (4
4096
4
3)4092 (1364

o likewiſe if 2, 6, 18, 54, 162,
, were given the Sum or Total
l the Terms will be found to
28. See the Work.

486
6) 18 (3
1458
2
2) 1456 (728

1. Three Geometrical Propor-
als given, the Square of the
n is equal to the Rectangle, or
duct of the Extreams.

o 8, 16, 32 being given, the Square of the Mean,
16 is 256, which is equal to the Product of the
reams 8 and 32, for 8 times 32 is equal to 256.

2. Of 4 Geometrical Proportional numbers given,
Product of the two Means is equal to the Product
he two Extreams.

o 8, 16, 32, 64, being given, I ſay that the pro-
t of the two Means, *viz.* 16 times 32, which is 512
qual to 8 times 64, the product of the Extreams.

Alſo if, 3, 9, 21, 69, were given (which are interrupted) I ſay 9 times 21 is equal to 3 times 63, whicl is equal to 189.

From hence ariſeth that precious Gem in Arithmetick, which for the Excellency thereof is called th *Golden Rule*, or *Rule of Three*,

CHAP. X.

The Single Rule of Three Direct.

1. THE Rule of Three (not undeſervedly call'd th Golden Rule) is, that by which we find ou a fourth *number*, in *proportion* unto *three* given *Number* ſo as this *fourth Number* ſought may bear the ſam Rate, Reaſon, or Proportion to the *third* (given) *number*, as the ſecond doth to the firſt, from whence it alſo called the Rule of *Proportion*.

2. Four *Numbers* are ſaid to be *Proportional*, when th firſt containeth or is contained by the ſecond, as oft as the third containeth, or is contained by the fourt *Vide Wingates Arith. Chap.* 8 *Sect.* 4.

So theſe *numbers* are ſaid to be *Proportionals*, *vi* 3, 6, 9, 18, for as often as the firſt *number* is contained in the ſecond, ſo often is the third containe in the fourth, *viz.* twice. Alſo 9, 3, 15, 5, are ſai to be *Proportional*, for as often as the firſt *number* co taineth in the ſecond, ſo often the third *number* contai eth the fourth, *viz.* 3 times.

3. The Rule of Three is either ſimple or compoſe

4. The ſimple (or ſingle) Rule of *Three*, conſiſte of 4 *numbers*, that is to ſay, it hath 3 *numbers* giv to find out a fourth; and this is either Direct, or I verſe. *Vide Alſted. Math. lib.* 2. *cap.* 13.

5 The ſingle Rule of *Three direct*, is when the P *portion* of the firſt *term* is to the ſecond, as the third to the fourth; or when it is required that the *numl*

ſoug

ght (*viz.*) the fourth *Number* muſt have the ſame *portion* to the ſecond,as the third hath to the firſt.

. In the Rule of *Three*, the greateſt difficulty is er the Queſtion is propounded) to diſcover the r of the 3 *terms*, *viz.* which is the firſt, which e ſecond,and which the third, which that you may erſtand,obſerve,That (of the three given *numbers*) are always of one kind, and the other is of the e kind with the *Proportional number* that is ſought ; n this Queſtion, *viz.* If 4 yards of Cloth coſt 12 lings, what will 6 yards coſt at that Rate? Here the *numbers* of one kind are 4 and 6, *viz.* they both ifie ſo many yards;and 12 ſhillings is the ſame kind h the *number* ſought, for the price of 6 yards is ght.

Again, obſerve, that of the 3 given *numbers*, thoſe o that are of the ſame kind,one of them muſt be the t, and the other the third, and that which is of the e kind with the *number* ſought, muſt be the ſecond *nber* in the Rule of *Three*; and that you may know ich of the ſaid *numbers* to make your firſt, and ich your third, know this that to one of thoſe o *numbers* there is always affixed a demand, and that *nber* upon which the demand lieth muſt always be koned the third *number*. As in the forementioned eſtion, the demand is affixed to the *number* 6, for it demanded what 6 yards will coſt? and therefore 6 ſt be the third *number*, and 4 (which is of the ſame nomination (or kind) with it) muſt be the firſt, and nſequently the *number* 12 muſt be the ſecond, and en the *numbers* being plac'd in the forementioned or-r will ſtand as followeth, *viz.*

yards	*s.*	*yards*
4	12	6

7. In the Rule of *Three Direct* (having placed the *nbers* as is before directed)the next thing to be done ll be to find out the fourth *number* in proportion, hich (that you may do) multiply the ſecond *number*

by the third, and divide the product thereof by th firſt,(or which is all one) multiply the third *term* (o number) by the ſecond,and divide the product thereo by the firſt,and the Quotient thence ariſing is the 4t *number* in a direct proportion,and is the *number* ſought or Anſwer to the queſtion, and is of the ſame denomination that the ſecond *number* is of. As thus, let th ſame queſtion be again repeated, *viz.* If 4 yards o Cloth coſt 12 ſhillings, what will 6 yards coſt?

Having placed my *numbers* according to the 6th Rule (of this Chapter) foregoing, I multiply (the ſecond *number*) 12,by (the third *number*) 6,and the Product is 72, which Product I divide by (the firſt *number*) 4, and the quotient thence ariſing is 18, which i the fourth *Proportional* or *number* ſought, *viz.* 18, ſhillings, (becauſe the ſecond *number* is ſhillings) which i the price of the 6 yards, as was required by the queſtion. See the Work following.

yds. *s.* *yds.* *s.*

If 4——12——6——18

6

4) 72 (18 *ſhillings*

4

32

32

(0)

Queſt. 2. Another Queſtion may be this, *viz.* I 7 *C.* of *Pepper* coſt 21 *l.* how much will 16 *C.* co at that Rate?

To reſolve which queſtion, I conſider that (according to the 6th Rule of this Chapter) the *terms* or *numbers* ought to be placed thus, *viz.* the Demand lyin upon 16 *C.* it muſt be the third *number*,and that of th ſame kind with it muſt be the firſt, *viz.* 7 *C.* and 21 (being of the ſame kind with the *number* ſought) mu be the ſecond *number* in this queſtion; then I procee

according

ccording to this 7*th* Rule, and multiply the ſecond umber or the third, *viz.* 21 by 16, and the Product is 36, which I divide by the firſt *number* 7, and the Quoent is 48 *l.* which is the value of 16 *C.* of Pepper at he rate of 21 *l.* for 7 *C.* See the Work following.

C. l. C.
If 7——21——16
16

126
21
l.
7) 336 (48

28

56
56 *facit* 48 *l.*

(0)

8. If when you have divided the Product of the ſecond and third numbers by the firſt, any thing remain fter Diviſion is ended, ſuch Remainder may be mulplyed by the parts of the next inferiour Denominaion, that are equal to an Unit (or Integer) of the ſecond number in the Queſtion, and the Product there f divide by the firſt number in the Queſtion and the uotient is of the ſame Denomination with the parts y which you multiplyed the Remainder, and is part of he fourth number which is ſought. And furthermore, f any thing remain, after this laſt Diviſion is ended, ultiply it by the parts of the next inferiour denomiation equal to an Unit of the laſt Quotient, and dide the Product by the ſame Diviſor (*viz.* the firſt umber in the Queſtion) and the quote is ſtill of the ame denomination with your Multiplyer; follow this ethod until you have reduced your Remainder into he loweſt Denomination, *&c.* An Example or two

will make the Rule very plain, which may be this following.

Queſt. 3. If 13 yards of Velvet (or any other thing) coſt 21 *l.* what will 27 yards of the ſame coſt at that Rate ?

Having ordered and wrought my Numbers according to the 6 and 7 Rules of this Chapter, I find the Quotient to be 43 *l.* and there is a Remainder of 8, ſo that I conclude the price of 27 *yards* to be more than 43 *l.* and to the intent that I may know how much more, I work according to the foregoing Rule, *viz.* I multiply the ſaid Remainder 8 by 20 *s.* (becauſe the ſecond number in the Queſtion was Pounds) and the product is 160; which divided by the firſt number, *viz.* 13, it quotes 12, which are 12 ſhillings, and there is yet a Remainder of 4, which I multiply by 12 pence, (becauſe the laſt quotient was ſhillings) and the product is 48, which I divide by 13 (the firſt number) and the Quotient is 3 *d.* and yet there remaineth 9, which I multiply by 4 *farthings*, and the product is 36, which divided by 13 again, it quotes 2 *farthings*, and there is yet a remainder of 10, which (becauſe it cometh not to the value of a *farthing*) may be neglected, or rather ſet (after the 2 *farthings*) over the diviſor, with a Line between them, and then (by the 21 and 22 Definitions of the firſt Chapter of this Book) it will be $\frac{10}{13}$ of a *farthing* ; ſo that I conclude, that if 13 *yards* of Velvet coſt 21 *l.* 27 *yards* of the ſame will coſt 43 *l.* 12 *s.* 03 *d.* 2 $\frac{10}{13}$ *qrs.* which Fraction is 10 thirteenths of a *farthing.* See the Operation as followeth.

yds. *l.* *yds.*
If 13——21——27
27

147
42

13) 567 (43*l.* pounds

52

47
39

Remains (8)
Multiply 20

13) 160 (12 shillings

13
30
26

Remains (4)
Multiply 12

13) 48 (3 *d.* pence
39
Remains (9)
Multiply 4
qrs. farthings
13) 36 (2$\frac{10}{13}$
26

l *s.* *d.* *qrs.*
Remains 10 *facit* 43—12—3 2$\frac{10}{13}$

ueſt. 4. Another Example may be this following, If 14 *l.* of *Tobacco* coſt 27 *s.* what will 478 *l.* coſt hat rate ?

Work according to the laſt Rule, and you will find it o amount to 921 *s.* 13 *d.* 1 $\frac{2}{14}$ *qrs.* and by the 5*th*

Rule of the 8*th*. Chapter 921 *s.* may be reduced to 46 01 *s.* So that then the whole worth or value of th 478 *l.* will be 46 *l.* 01 *s* 10 *d.* 1 $\frac{2}{14}$ *qrs.* the whol Work followeth.

l. *s.* *d.*
If 14—27—478
27

3346
956

14) 12906 (921
126

30
28

26
14

Remains (12)
Multiply 12

24
12

14) 144 (10
14

Remains 4
Multiply 4
qrs.
14) 16 (1 $\frac{2}{14}$
14

Rem. (2)

2|0) 92|4 (46
8

12
12

01

l. *s.* *d.* *qrs.*
Facit 46——01——10——1 $\frac{2}{14}$

9. In the Rule of Three it many times happeneth,
at although the firſt and third numbers be Homoge-
al (that is, of one kind) as both Money, Weight,
eaſure, &c. yet they may not be of one denomina-
n, or perhaps they may both conſiſt of many deno-
nations, in which caſe you are to reduce both num-
rs to one denomination; and likewiſe your ſecond
mber (if it conſiſteth (at any time) of divers deno-
inations) muſt be reduced to the leaſt name menti-
ed, or lower if you pleaſe, which being done, mul-
ply ſecond and third together,and divide by the firſt,
is directed in the 7*th* Rule of this Chapter.

And note that always the Anſwer to the Queſtion is
the ſame denomination that your ſecond number
of, or is reduced to, as was hinted before.

Queſt. 5. If 15 Ounces of Silver be worth 3 *l.*
s. what are 86 Ounces worth at that Rate?

n this Queſtion the numbers being ordered accord-
g to the 6*th* Rule of this Chapter, the firſt and third
mbers are ounces,and the ſecond number is of divers
nominations, *viz.* 3 *l.* 15 *s.* which muſt be reduced
ſhillings, and the ſhillings multiplyed by the third
mber, and the product divided by the firſt, gives
u the anſwer in ſhillings, *viz.* 430 ſhillings, which
e reduced to 21 *l.* 10 *s.* See the Work.

```
      oz.   l.    s.    oz.
   If 15————3————15————86
            20
           ————
            75
            86
           ————
           450
          600
         ————— 2|0)  l.    s.
   15) 6450 (43|0  21.——10
       ...
         60         4
        ————      ————
         45         3
         45         2
       ——————    ——————
         (0)       (10) ſhillings
```

In reſolving the laſt Queſtion, the Work would have been the ſame, if you had reduced your ſecond number into pence, for then the Anſwer would been 5160 pence, equal to 21 *l.* 10 *s.* or if you had reduced the ſecond number into farthings, the Quotient or Anſwer would have been 20640 farthings equal to the ſame, as you may prove at your leiſure.

Queſt. 6. If 8 *l.* of Pepper coſt 4 *s.* 8 *d.* what will 7 *C.* 3 *qrs.* 14 *l.* coſt?

In this Queſtion the firſt *number* is 8 *l.* and the third is 7 *C.* 3 *qrs.* 14 *l.* which muſt be reduced to the ſame denomination with the firſt, *viz.* into pounds, and the ſecond *number* muſt be reduced into pence; then multiply and divide according to the 7*th.* Rule foregoing, and you will find the Anſwer to be 6174 pence, which is reduced into 25 *l.* 14 *s.* 6. *d.*

```
     l.    s.  d.              C. qrs.  l.
  If 8 coſt 4—8— what will 7—3—14 coſt?
           12                  4
          ----                ---
           56                  31
                               28
                              ----
                               252
                               63
                              -----
                               882
                                56 ſecond number
                              -----
                               5292
                              4410
                             ------  12)        2|0)  l.
                         8) 49392 (6174  (51|4 (25
                             ....     ...
                            48       60      4
                           ----     ----    ---
                            13       17      11
                             8       12      10
                           ----     ----    ---
                            59       54      14 ſhillings
                            56       48
                           ----     ----
                            32      (6) pence
                            32
                           ----         l.   s.  d.
                            (0) Facit 25—14—6
```

eſt. 7. If 3 *C.* 1 *qr.* 14 *l.* of Raiſins coſt 9 *l.* 9 *s.*
will 6 *C.* 3 *qrs.* 20 *l.* of the ſame coſt?
re the firſt and third numbers each conſiſt of di-
denominations, but muſt be brought both into
denomination, *&c.* as you ſee in the Operation
h followeth; the Anſwer is 388 *s.* which is re-
l into 19 *l.* 8 *s.*

```
C.  qr.  l.       l.   s.              C.  qrs. l.
3—1—14 coſt—9—9 what will 6—3—20 coſt?
4                20                  4
——              ———                 ———
13               189                 27
28                                   28
——                                  ———
08                                   216
27                                   56
——                                  ————
78 pounds                            776 pounds
                                     189 ſecond number
 6984                               ————
6208                                      2|0) l.  d.
776                          378)146664(38|8 19—8
                                 ....    2
                               1134    ———
                              ————      18
                              3326      18
                              3024     ———
                              ————    (08) ſhillings
                              3024
                               3024           l.  s.
                              ————facit 19—8
                               (0)
```

ſt. 8. If in 4 *weeks* I ſpend 13 *s.* 4. *d* how long
3 *l.* 6 *s.* laſt me at that rate?
wer 2238 *days* equal to 6 *years*, 48 *days*. See
Work.

s. d. w. l. s.
If 13—4 *require* 4 *what will* 53—06 *coſt ?*
12 7 20
30 28 *days* 1066
13 12
160 *pence* 2132
1066
12792 *pence*
28 *ſecond number*
102336
25584
(365
16|0) 35817|6 (2238 (6 *ya*
• • • • 2190
32
Rem. (48) *days*
38
32
61 *ye. days*
48 *fac.* 6—48 $\frac{96}{160}$
137
128
Remains (96)

Queſt. 9, Suppoſe the yearly Rent of a Houſ
yearly Penſion, or Wages be 73 *l.* I deſire to kn
how much it is *per* day ?

Here you are to bring the year into days, and
if 365 days require 73 *l.* what will one day requi

Now when you come to multiply 73 by 1, the I
duct is the ſame, for 1 neither multiplyeth nor d
deth, and 73 cannot be divided by 365, becauſe

Div

iſor is bigger than the Dividend, wherefore bring
73 *l.* into ſhillings, and they make 1460, which
ide by the firſt number 365, and the quote is 4
llings for the Anſwer, as you ſee in the Work.

days *l.* *day*
If 365——73——1
20

365) 1460 (4 *s.*
1460 *facit* 4 *s. per* Day

(0)

Queſt. 10. A Merchant bought 14 pieces of Broad
th, each piece containing 28 yards, for which he
e after the Rate of 13 *s.* 6½ *d. per* yard, now I
re to know how much he gave for the 14 pieces
hat Rate?
irſt, Find out how many yards are in the 14 pie-
which you will do if you multiply the 14 pieces
28 (the number of yards in a piece) and it makes
; then ſay, If 1 yard coſt 13 *s.* 6½ *d.* what will
yards coſt? Work as followeth; and the Anſwer
will find to be 127400 half-pence, which reduced
e 265 *l.* 8 *s.* 4 *d.* For after you have multiplyed
r ſecond and third Numbers together, the Product
27400, which (according to the ſeventh Rule)
ld be divided by the firſt number, but the firſt
ber is 1, which neither multiplyeth nor divideth,
therefore the Quotient or fourth number is the
e with the Product of the ſecond and third, which
n half-pence, becauſe the ſecond number was ſo
ced. See the Work, as followeth.

```
                              28
                              14
                            ----
                             112
                              28
                            ----
                             392 yards in the 14 piece

yard       s.    d.           yards
If 1 coſt  13—6½ what-will   392 coſt?
           12                 325 the ſecond number
          ----               -----
           32                 1960
          13                  784
         ----                1176
          162               ---------  2|0      l.
            2            24) 127400 (530|8 (265|6
          ----                ....    ...
half-pence 325                120      4
                              ---    ----
                              74    -13
                              72     12
                              ---    ---
                              200    10
      l.   s.   d.                   10
Facit 265—8—4                 192   ----
                              ---- (0) ſhillings
                      Rem. (8) ½ pence, or 4 d.
```

Queſt. 11. A Draper bought 420 *yds* of broad-clot and gave for it after the Rate of 14 *s.* 10 *d.*$\frac{3}{4}$ *per* E *Engliſh*; now I demand how much he paid for th whole at that Rate?

Bring your Ell into quarters, and your given yar into quarters, the Ell is 5 quarters, and in 420 yar are 1680 quarters, then ſay, If 5 quarters coſt 14 10 $\frac{3}{4}$ *d.* (or 715 *farthings*) what will 1680 quarte coſt? *facit* 250 *l.* 0 5*s.* 00 *d.* See the Operation.

```
     Ell          Yards
      1            420
      5              4
     ----        ------
     5 qrs.       1680 qrs.
 qrs.    s.      d.          s.
If 5 —— 14 —— 10¾ —— 1680
        12                    715
       ----                 ------
        28                   8400
        15                  1680
       ----               11760
       178 d.             ———————— 96|0)        l.
         4          5) 1201200 (24024|0 (250
       ----            . . . . . .      . . .
       715 qrs.          10            192
                        ----          ------
   l.    s.    d.        20            482
cit 250—5—00             20            480
                        ----          ------
                         12  Rem. (240) qrs. or 5s.
                         10
                        ----
                         20
                         20
                        ----
                        (0)
```

eſt. 12. A Draper bought of a Merchant 50 pie-
f Kerſeys, each piece containing 34 Ells *Flemiſh*,
Ell *Flemiſh* being 3 quarters of a yard) to pay
the Rate of 8 *s.* 4 *d. per* Ell *Engliſh*, I demand
much the 50 pieces coſt him at that rate?
rſt, Find how many Ells *Flemiſh* are in the 50 pie-
y multiplying 50 by 34, the product is 1700,
h bring into quarters by 3, it makes 5100 quar-
then proceed, as in the laſt Queſtion, and the
ver you will find to be 102000 pence, or 425 *l.*
ld the Operation, as followeth.

If

```
qrs. s.  d.          qrs.
If 5—8—4————————5100                    50
   12              100                  34
   ——            ————        d.        ——
   110d.  5) 510000 (102000            200
             ••••••                     150
               5                      ————
              ——                      1700 Ells Flem.
              10                         3
              10                      ————
              ——                      5100 quarters
              (0)          2|0)       l.
         12) 102000 (850|0 (425
               ••       ••
               96       8
              ——       ——
               60       5
               60       4
              ——       ——
              (0)      10
                       10
                       ——
Facit 425 pound        (0)
```

Queſt: 13. A Goldſmith bought a Wedge of Gol which weighed 14 *l.* 3 *oz.* 8 *p.w.* for the Sum 514 *l.* 4 *s.* I demand what it ſtood him in *per* Ounce Anſwer 60 ſhillings, or 3 *l.* See the Work.

```
   lb      oz.      p.w.        l.         s.    oz.
If 14———————3————————8——————————514————————4———1
   12                           20 ſhillings    20
  ——                           ————            ————
   31                          10284 ſhillings  20p.w
   14                             20 p.w.
  ——                           ————  2|0)
  171 oz.           3428) 205680 (6|0   (3 l.
   20                        ••  6
  ——                       20568 ———        s.
  3428 p.w.                ————  (0) facit 60 or
                            (0)              Que
```

Queſt. 14. A Grocer bought 4 *hhds* of Sugar, each
eighing near 6 *C.* 2 *qrs.* 14 *l.* which coſt him 2 *l.*
. 6 *d. per* C. I demand the value of the 4 *hhds* at
at rate?

First, Find the weight of the 4 *hhds*, which you may
by reducing the weight of one of them into pounds
d multiply them by 4 (the Number of *hhds*) and
ey make 2968 *l.* then ſay, If 1 *C.* or 112. *l.* coſt
. 8 *s.* 6 *d.* what will 2968 *l.* coſt? *Facit* 64 *l.* 5 *s.*
d. As by the Operation.

```
                                        C.    qrs.    l.
                                        6 ——— 2 ——— 14
                                        4
                                       ————
                                        26
                                        28
                                       ————
   l.    l.  s.  d.      l.            212
If 112—2—8—06— 2968                     53
        20               582           ————
       ————             ——————          472 l. in 1 hhd.
        48               5936             4 hogſheads
        12              23744          ————
       ————             14840          2968 l. in 4 hhds.
       102             ————————        12)        2|0)     l.
        48        112) 1727376 (15423 (128| 5 (64
       ————                 .....     ....      ..
       582                112           12         12
                         ————          ————       ————
                          607           34          8
                          560           24          8
                         ————          ————       ————
                          473          102       (05) ſhillings
                          448           96
                         ————          ————
                           257          63
                           224          60
                          ————         ————
                           336         (3) pence
                           336
                          ————
                           (0)
            l.      s.     d
    Facit 64 ——— 5 ——— 3.
```

Queſt. 15. A Draper bought of a Merchant 8 pac of Cloth, each pack containing 4 parcels, and eac parcel 10 pieces, and in each piece 25 yards, an gave after the *Rate* of 4 *l.* 16 *s.* for 6 yards, now desire to know how much he gave for the whole? *A-ſwer,* 6656 *l.*

Firſt, Find out how many yards there were in t 8 packs, as by the following work you will find the are 8320 yards; then ſay if 6 yards coſt 4 *l.* 16 what will 8320 yards coſt, *&c.*

```
                                       8 packs
                                       4
                                     -----
                                       32 parcels
                                       10
                                     -----
                                       320 pieces
   yds. l.   s.  yds.                  26
If  6 — 4 — 16 — 8320                -----
      20          96                   1920
   -------     --------                640
      96        49920                -----
                74880                  8320 yds
             ------------2|0)          l.
           6) 798720 (13312|0(6656
              ......  .....
              6          12
             ----      -----
              19         13
              18         12
             ----      -----
              18         11
              18         10
             ----      -----
               07         12
               6          12
             ----      -----
               12         (0)
               12
Facit 6656 l. ----
               (0)
```

By this time the Learner is (I ſuppoſe) well exerci-d in the Practick and Theorick of the Rule of Three irect, but at his leiſure he may look over the follow- g Queſtions, whoſe Anſwers are given, but the ope- tion purpoſely omitted as a Touchſtone for the earner, thereby to try his Ability in what hath been livered in the former Rules.

Queſt. 16. If 24 *l.* of *Raiſins* coſt 6 *s.* 6 *d.* what will 3 Frails coſt, each weighing Neat 3 *qrs.* 18 *l.* *Anſwer* 4 *l.* 17 *s.* 03 *d.*

Queſt. 17. If an Ounce of Silver be worth 5 ſhil- ngs, what is the price of 14 Ingots, each Ingot eighing 7 *l.* 5 *oz.* 10. *p.w.*? *Anſwer* 313 *l.* 5 *s.*

Queſt. 18. If a piece of Cloth coſt 10 *l.* 16. *s.* 8 *d.* demand how many Ells *Engliſh* there are in the me, when the Ell at that rate is worth 8 *s.* 4 *d.*? *nſw.* 26 Ells *Engliſh.*

Queſt. 19. A Factor bought 84 pieces of Stuffs, hich coſt him in all 537 *l.* 12 *s.* at 5 *s.* 4 *d. per* yar. demand how many Yards there were in all, and w many Ells *Engliſh* were contained in a piece of e ſame? *Anſwer* 2216 Yards in all, and $19\frac{1}{5}$ Ells *gliſh per* piece.

Queſt. 20. A Draper bought 242 yards of Broad- oth, which coſt him in all 254 *l.* 10 *s.* for 86 yards, which he gave after the rate of 21 *s.* 4 *d. per* yard, demand how many he gave *per* yard for the *Remain*- r? *Anſw.* 20 *s.* 10 *d.* $\frac{64}{156}$ *per* yard.

Queſt. 21. A Factor bought a certain quantity of rge and Shalloon, which together coſt him 26 *l.* 14 *s.* *d.* the quantity of Serge he bought was 48 yards 3 *s.* 4 *d. per* yard, and for every two yards of Serge had 5 yards of Shalloon, I demand how many rds of Shalloon he had, and how much the Shalloon ſt him *per* yard? *Anſw.* 120 yards of Shalloon at 1 *l.* 5 *s.* 05 $\frac{58}{120}$ *d. per* yard.

Queſt. 22. An Oyl-man bought 3 Tun of Oyl, which ſt him 151 *l.* 34 *s.* and it ſo chanced that it leaked t 85 gallons, but he is minded to ſell it again, ſo as at he may be no loſer by it, I demand how he

muſt ſell it *per* gallon? *Anſwer*, at 4 *s.* $6\frac{174}{671}$ *d.*
gallon.

Queſt. 23. Bought 6 packs of Cloth, each pack co
taining 12 Cloths, which at 8 *s.* 4 *d.* *per Ell Flem*
coſt 1080 *l.* I demand how many yards there were
each Cloth? *Anſwer* 27 yards in each Cloth.

Queſt. 24. A Gentleman hath 536 *l. per annum*, a
his Expences are one day with another 18 *s.* 10
3 *qrs.* I deſire to know how much he layeth up
the years end? *Anſwer* 191 *l.* 3 *s.* 0 *d.* 1 *qr.*

Queſt. 25. A Gentleman expendeth daily one d
with another 27 *s.* $10\frac{1}{2}$ *d.* and at the years end la
eth up 340 *l.* I demand how much is his yearly I
come? *Anſwer* 848 *l.* 14 *s.* 4 *d.* $\frac{1}{2}$.

Queſt. 26. If I ſell 14 yards for 10 *l.* 10 *s.* 00
how many Ells *Flemiſh* ſhall I ſell for 283 *l.* 17 *s.* 6
at that rate? *Anſwer* $50\frac{2}{3}$ Ells *Flemiſh.*

Queſt. 27. If 100 *l.* in 12 Months gain 6 *l.* In
reſt, how much will 75 *l.* gain in the ſame time, a
at the ſame rate? *Anſwer* 4 *l.* 10 *s.*

Queſt. 28. If 100 *l.* in 12 Months gain 6 *l.* In
reſt, how much will it gain in 7 Months at that rat
Anſwer 3 *l.* 10 *s.*

Queſt. 29. A certain Uſurer put out 75 *l.* for
Months, and received Principal and Intereſt 81 *l*
demand what rate *per Cent.* he received Intereſt?
ſwer, 8 *l. per Cent.*

Queſt. 30. A Grocer bought 2 Cheſts of Sugar,
one weighed neat 17 *C.* 3 *qrs.* 14. *l.* at 2 *l.* 6 *s.* 8
per C. the other weighed neat 18 *C.* 1 *qr.* 21 *l.* at $4\frac{1}{2}$
per l. which he mingleth together, now I deſire
know how much a *C. weight* of this mixture is wort
Anſwer 2 *l.* 4 *s.* 3 *d.* $2\frac{5659}{40067}$ *qrs.*

Queſt. 31. Two men. *viz.* *A* and *B.* departed b
from one place, the one goes Eaſt, and the other W
the one travelleth 4 miles a day, the other 5 mile
day, how far are they diſtant the *9th.* day after th
departure? *Anſwer* 81 *miles.*

Qu

Queſt. 32. *A* flying every day 40 miles is purſued the 4*th* day after by *B*, poſting 50 miles a day, now the Queſtion is in how many days, and after how many miles Travel will *A* be overtaken ?

re's *Arithm.*
*ap.*8.*Queſt.*7.

ſwer, *B* overtakes him in 32 days, when they have velled 600 miles.

11. The general Effect of the Rule of Three Di-t, is contained in the definition of the ſame, that is, find a fourth Number in proportion conſiſting of o equal Reaſons, as hath been fully ſhewn in all the egoing Examples.

The ſecond Effect is, by the price or value of one ng to find the price or value of many things of like nd.

The third Effect is, by the price or value of many ngs to find the price of one, or by the price of ny things (the ſaid price being 1) to find the price many things of like kind.

The fourth Effect is, by the price or value of many ngs, to find the price or value of many things of e kind.

The fifth Effect is, thereby to reduce any Number Monys, Weight, or Meaſure, the one ſort into the her, as in the Rules of *Reduction* contained in the ghth Chapter foregoing. Examples of its various fects have been already anſwered.

The Proof of the Rule of Three Direct.

12. The Rule of 3 Direct is thus proved, *viz.* mul-ly the firſt Number by the fourth, l note the Product, then multi- the ſecond number by the third, l if this Product is equal to the duct of the firſt and fourth, then work is rightly performed, otherwiſe it is erroneous.

So the firſt Queſtion of this Chapter (whoſe An-er, or fourth number we found to be 18 *s.*) is thus ved, *viz.* the firſt number is 4, which multiplied 18 (the fourth) produceth 72. And the ſecond and rd numbers are 12 and 6, which multiplied toge-r produce 72, equal to the Product of the firſt and rth, and therefore I conclude the work to be right-performed.

Always obſerving, that if any thing remain after
have divided the product of the ſecond and third r
bers, by the firſt, ſuch remainder in proving the f
muſt be added to the Product of the firſt and fo
Numbers, whoſe Sum will be equal to the Produ
the ſecond and third, (the ſecond *number* being of
ſame denomination with the fourth, and the firſt
the ſame denomination of the third.)

So the Fourth Queſtion of this Chapter t
again repeated, *viz.* If 14 *l.* of Tobacco coſt
what will 478 *l.* coſt at that Rate? The Anſwe
fourth *number*) was 45 *l.* 01 *s.* 10 *d.* 1 *qr.* $\frac{2}{14}$, w
is thus proved, *viz.* bring the fourth *number* int
things, and it makes 44249, which multiplyed b
firſt *number* 14, produceth 619488 (the ſecond w
remaineth being added thereto) then (becauſe
duce my fourth *number* into *farthings*,) I reduce
ſecond (*viz.* 27 *s.*) into *farthings*, and they are
which multiplyed by the third *number* 478, their
duct is 619488 equal to the Product of the *firſ*
fourth Numbers. Wherefore I conclude the Oper
to be true. This is an infallible way to prov
Rule of Three *Direct*, and it is deduced from the
Section of the 9*th*. *Chapter* of this Book.

Thus much concerning the ſingle Rule of
Direct, and I queſtion not but by this time the
ner is ſufficiently qualified to reſolve any qu
pertinent to this Rule, not relying upon *Fracti*
Geometrical Magnitudes. Thoſe that are deſirous
the Demonſtration of this Rule, let them rea
ſixth Chapter of (the ingenious) Mr. *Kerſeys* App
to *Wingates* Arithmetick. Or the *ſixth Chapter*
Oughtreds (Incomparable) *Clavis Mathematicæ*
both which Authors this Rule is largely demonſt
being grounded upon the 19*th*. *Prop*. of the 7*th*
the 19*th*. *Prop*. of the 9*th* of *Euclid*. *Elem*.

C H A

CHAP. XI.

The Single Rule of Three Inverſe.

THE Golden Rule,or Rule of 3 Inverſe,is when
there are 3 *Numbers* given to find a fourth, in
proportion to the 3 given Numbers, ſo as the
h proceeds from the ſecond, according to the
Rate, Reaſon, or Proportion that the firſt pro-
from the third, or the Proportion is,
the third *number* is in propor-
to the ſecond, ſo is the firſt to
ourth.

Alſted. Math. lib. 2. *cap.* 14.

if the 3 *numbers* given were 8,12, and 16,and it
required to find a fourth *number* in an inverted
ortion to theſe, I ſay that as 16 (the third *Num-*
is the double of the firſt *term* or *number* (8) ſo
12 (the ſecond *number*) be the double of the
h; ſo will you find the fourth *term* or *number* to
And as in the Rule of 3 *Direct*, you multiply the
d and third together, and divide their Product
fourth *Proportional Number*.

In the Rule of 3 *Inverſe*, you muſt multiply the
d *term* by the firſt (or firſt *term* by the ſecond)
ivide the Product thereof by the third *term*,ſo the
ent will give you the fourth *term* ſought in an In-
d *Proportion*.The ſame order being obſerved in this
as in the Rule of 3 *Direct*, for placing and di-
g of the given *numbers*, and after your *numbers*
aced in order, that you may know whether your
ien be to be reſolved by the Rule *Direct* or *In-*
obſerve the general Rule following.

When your Queſtion is ſtated, and your *numbers*
y diſpoſed, Conſider in the firſt place whether
urth *term* or *number* ſought, ought to be more
than the ſecond *term*; which you may eaſily
And if it is required to be more, or greater than
cond *term*, then the leſſer *Extream* muſt be your
or; but if it require leſs, then the biggeſt *Ex-*

tream muſt be your Diviſor, (in this Caſe the fi third *numbers* are called *Extreams* in reſpect of cond,) and having found out your Diviſor, yo know whether your Queſtion belong to the Rul or *Inverſe*; for if the third *term* be your Diviſor it is *Inverſe*, but if the firſt *term* be your Diviſo it is a *Direct* Rule, As in the following Queſti

Queſt. 1. If 8 Labourers can do a ceartain p work in 12 days, in how many days will 16 rers do the ſame? *Anſwer* in 6 days.

Having placed the *numbers* according to the of the 10*th* Chapter, I conſider that if 8 Men can finiſh the Work in 12 days, 16 Men will do it in leſſer (or fewer days, than 12,) therefore the biggeſt *Extream* muſt be the Diviſor, which is 16, and therefore it is the Rule of 3 *Inverſe*, wherefore I multiply the firſt and ſecond *numbers* together, *viz.* 8 by 12, and their *Product* is 96, which divided by 16, Quotes 6 days for the *Anſwer*, and in days will 16 Labourers perform a piece o when 8 can do it in 12 days.

```
lab.     days
  8 ——— 12
         8
        ——
   16) 96
       96
       ——
       (0
 Facit  6
```

Queſt. 2. If when the meaſure (*viz.* a peck) o coſt 2 ſhillings, the penny Loaf weighed (acc the Standard, Stature, or Law of *England*) 8 demand how much it will weigh when the worth 1 *s.* 6 *d.* according to the ſame Rate o tion? *Anſwer* 10 *oz.* 13 *p.w.* 8 *gr.*

Having placed and reduced the given *numb* ding to the 6 and 9 Rules of the 10*th* Chapt ſider, that at 1 *s.* 6 *d. per* peck, the penny weigh more than at 2 *s.* . *per* peck, for as decreaſeth, the weight increaſeth, and as the creaſeth, ſo the weight diminiſheth, wherefo the firſt *term* requireth more than the ſecond *Extream* muſt be the Diviſor, 1 *s.* 6 *d.* or having finiſhed the work, I find the *Anſwer* to *w.* 8 *gr.* and ſo much will the penny Loaf weigh, the peck of Wheat is worth 1 *s.* 6 *d.* according given rate of 8 ounces, when the peck is worth ngs, the work is plain in the following operation.

```
                         s.             d.
2 ───────── 8 ───────── 1 ──────────── 6
           24           12
          ───          ───
           32           18
          16
        ─────── oz.  p. w.  gr.
    18) 192  (10 ── 13 ── 8
         ..
        ─────
  Rem. (12)
  ──────── p.w.
   18) 240 (13
        18
       ────
        60
        54
       ─────
        (6)
        24
       ────── gr.
    18) 144 (8
        144
       ──────
        (0)
```

ueſt. 3. How many pieces of Mony or Merchandiſe *s. per* piece are to be given or received for 240 es, the value or price of every piece being 12 ſhil- ? *Anſwer*, 144. For if 12 *s.* require 240 pieces, 20 ſhillings will require leſs ; therefore the big- *Extream* muſt be the Diviſor, which is the third ber, &c. See the Work.

```
      s.  pieces  s.
   If 12—240—20
           12
         ————
          480
         240
      ——————————
2|0) 288|0 (144 pieces at 20 s. per piece
      2
    ————
       8
       8
     ————
        8
        8
      ————
       (0)
```

Queſt. 4. How many yards of 3 quarters broad required to double, or be equal in meaſure to 30 yards, that are 5 quarters broad? *Anſwer* 50 yards, For ſay, if 5 quarters wide require 30 yards long, what length will three quarters broad require? Here I conſider that 3 quarters broad will require more yards than 30, for the narrower the Cloath is, the more in length will go to make equal meaſure with a broader piece.

```
qrs.———long———
 5        30
           5
        ————
   3) 150 (50
        15
       ————
       (0)
```

Queſt. 5. At the Requeſt of a Friend I lent h 200 *l.* for 12 Months, promiſing to do me the l Courteſie at my Neceſſity; but when I came to queſt it of him, he could let me have but 150 *l.* n I deſire to know how long I may keep this Mo to make plenary ſatisfaction for my former kind to my Friend? *Anſwer* 16 Months. I ſay, if 200 require 12 Months, what will 150 *l.* require? 150 will require more time than 12 Months, therefore t leſſer *Extream* (*viz.* 150) muſt be the Diviſor, Mul

p

and divide, and you will find the fourth inverted *tional* to be 16, and ſo many Months I ought to the 150 *l.* for ſatisfaction.

eſt. 6. If for 24 *s.* I have 1200 *l.* weight carried miles how many miles, ſhall 1800 *l.* be carried the ſame Money? *Anſwer* 24 Miles.

eſt. 7. If for 24 *s.* I have 1200 *l.* carried 36 s, how many pound weight ſhall I have carried miles for the ſame Money? *Anſwer* 1800 l. ght.

eſt. 8. If a 100 Workmen in 12 days finiſh a piece ork or ſervice, how many Workmen are ſufficient o the ſame in 3 days? *Anſwer* 400 Workmen.

Queſt. 9. A Colonel is beſieged in a Town in which 1000 Soldiers, with proviſion of Victuals only for onths, the Queſtion is how many of his Soldiers t he diſmiſs, that his Victuals may laſt the remai g Soldiers 6 months? *Anſwer*, 500 he muſt keep, diſmiſs as many.

Queſt. 10. If Wine worth 20 *l.* is ſufficient for the dinary of 100 Men, when the Tun is ſold for 30 *l.* v many Men will the ſame 20 pounds worth ſuffice, en the Tun is worth 24 *l.* *Anſwer*, 125 Men.

Queſt. 11. How much Pluſh is ſufficient to line a oak which hath in it 4 yards of 7 quarters wide, hen the Pluſh is but 3 quarters wide? *Anſwer*, $9\frac{1}{3}$ rds of Pluſh.

Queſt. 12. How many yards of Canvas that is Ell de, will be ſufficient to line 20 yards of Say, that 3 quarters wide? *Anſwer*, 12 yards.

Queſt. 13. How many yards of Matting that is two ot wide, will cover a Floor that is 24 Foot long, and Foot broad? *Anſwer*, 240 Foot.

Queſt. 14. A Reigment of Soldiers conſiſting of 00, are to have new Coats, and each Coat to con n 2 yards, 2 quarters of Cloth, that is 5 quarters de, and they are to be lined with Shalloon that is quarters wide, I demand how many yards of Shal on will line them? *Anſwer*, $16566\frac{2}{3}$ quarters of rds, or $4166\frac{3}{4}$ yards.

Queſt. 15. A Meſſenger makes a Journey in 24 day: when the day is 12 hours long, I deſire to know i how many days he will go the ſame when the day 16 hours long? *Anſwer*, in 18 days.

Queſt. 16. Borrowed of my Friend 64 *l.* for Months, and he hath occaſion another time for to borrow of me for 12 Months, I deſire to know hov much I muſt lend to make good his former kindne to me? *Anſwer*, 42 *l.* 13 *s.* 04 *d.*

4. The general Effect of the Rule of 3 *Inverſe* is contained in the definition of the ſame, that is, to find fourth *term* in a Reciprocal Proportion, inverted t the Proportion given.

The ſecond Effect, is by two prices, or values c two ſeveral pieces of Money or Merchandize known to find how many pieces of the one price is to be given for ſo many of the other. And conſequently t Reduce and Exchange one ſort of Money, or Merchandize, into another. Or contrariwiſe to find th price unknown of any piece given to Exchange in Reciprocal Proportion.

The third Effect, is, by two differing prices of meaſure of Wheat bought or ſold, and the weight c the Loaf of Bread, made anſwerable to one of th prices of the meaſure given, to find out the weigh of the ſame Loaf anſwerable to the other price c the ſaid meaſure given. Or Contrariwiſe by the tw ſeveral weights of the ſame prized Loaf, and the pric of the meaſure of Wheat anſwerable to one of tho Weights given, to find out the other price of th meaſure anſwerable to the other weight of the ſam Loaf.

The fourth Effect, is, by two lengths, and on breadth of two Rectangular Planes known, to find ou another breadth unknown. Or by two bredths an one length given, to find out another length unknow in an inverted Proportion.

The fifth Effect, is, by double time and a capita Sum of Money borrowed or Lent, to find out anothe capital Sum anſwerable to one of the given Times

or

otherwiſe, by two Capital Sums, and a time anſwer-
le to one of them given to find out a time anſwer-
le to the other Capital Sum in Reciprocal Reaſon.

The ſixth Effect is, by two differing Weights of
arriage, and the diſtance of the places in Miles or in
eagues given, to find another diſtance in miles an-
erable to the ſame price of payment: Or otherwiſe
two diſtances in miles, and the weight anſwera-
e to one of the diſtances (being carried for a cer-
in price) to find out the weight anſwerable to the
ther diſtance for the ſame price.

The ſeventh Effect is by double Workmen, and the
me anſwerable to one of the *numbers* of Workmen gi-
en, to find out the time anſwerable to the other
nber of Workmen,in the performance of any work or
rvice.Or contrariwiſe,by double time and the Work-
en anſwerable to one of thoſe times given, to find
t the *number* of Workmen anſwerable to the other
me, in the performance of any work or ſervice.

Alſo by a double price of Proviſion, and the *num-*
er of Men, or other Creatures nouriſhed for a cer-
in time, anſwerable to one of the prices of Proviſion
iven, to find out another Number of Men or other
reatures anſwerable to the other price of the Provi-
on for the ſame time. Or contrariwiſe by two *num-*
ers of Men or other Creatures nouriſhed, and one
rice of Proviſion anſwerable to one of the *numbers* of
reatures given, to find out the other price of the
me Proviſion anſwerable to the other *number* of Crea-
res, both being ſuppoſed to be nouriſhed for the
me, &c. As in the foregoing Examples is fully de-
lared.

To prove the Operation of the Rule of 3 *Inverſe*,
ultiply the third and fourth *terms* together,and note
eir Product; and multiply the firſt and ſecond to-
ether, and if their Product is equal to the Product
f third and fourth, then is the Work truly wrought,
ut if it falleth out otherwiſe, then it is erroneous.

As in the firſt Queſtion of this Chapter, 15 (the
hird *number*) being multiplied by 6(the fourth *number*)

the Product is 96, and the Product of 8 (the firſt number) multiplyed by 12 (the ſecond number) is 96, equal to the firſt Product, which proves the work to be right.

And Note, that if in Diviſion any thing remain, ſuch Remainder muſt be added to the Product of the third and fourth terms, and if the Sum be equal to the Product of the firſt and ſecond (the homogeneal terms being of one denomination) the work is right.

CHAP. XII.

The Double Rule of Three Direct.

WE have already delivered the Rules of *Singl* *Proportion*, and we come now to lay down the Rules of *Plural Proportion*.

1. *Plural Proportion*, is when more Operations in the Rule of Three than one, are required before a Solu- tion can be given to the Queſtion propounded. There- fore in Queſtions that require Plurality in *Proportion* there are always given more than three *numbers*.

2. When there are given 5 *numbers*, and a ſixth i required in *Proportion* thereunto, then this ſixth *Pro- portion* is ſaid to be found out by the double Rule of 3. as in the Queſtion following, *viz*.

If 100 *l.* in 12 months gain 6 *l.* Intereſt, how much will 75 *l.* gain in 9 months?

3. Queſtions in the double Rule of 3 may be re- ſolved either by two ſingle Rules of Three, or by one ſingle Rule of Three, compounded of the five given *Numbers*.

4. The double Rule of 3 is either *Direct*, or elſ *Inverſe*.

5. The double Rule of 3 *Direct*, is when unto given *Numbers* a ſixth *proportional* may be found ou by two ſingle Rules of Three *Direct*.

6. The five given *Numbers* in the double Rule o

Thre

hree conſiſts of 2 parts, *viz.* Firſt, a Suppoſition, and econdly, of a Demand; the Suppoſition is contained n the *three firſt* of the *five* given *Numbers*, and the De-and lies in the two laſt; as in the Example of the econd Rule of this Chapter, *viz.* If 100 *l.* in 12 onths gain 6 *l.* Intereſt, what will 75 *l.* gain in 9 onths? Here the Suppoſition is expreſſed in 100, 12, nd 6; for it is ſaid, if (or ſuppoſe) 100 *l.* in 12 onths gain 6 *l.* Intereſt, and the Demand lyeth in 5 and 9; for it is demanded how much 75 *l.* will ain in 9 months?

7. When your Queſtion is ſtated, the next thing will be to diſpoſe of the given Numbers in due order nd place, as a Preparative for Reſolution; which hat you may do, Firſt, obſerve which of the given Numbers in the Suppoſition is of the ſame Denomina-ion with the Number required; for that muſt be the econd number (in the firſt operation) of the ſingle Rule f 3, and one of the other Numbers in the Suppoſi-ion (it matters not which) muſt be the firſt Number, nd that Number in the Demand which is of the ſame Denomination with the firſt, muſt be the third number, which three Numbers being thus placed will make one perfect Queſtion in the ſingle Rule of Three, as in the forementioned Example: Firſt, I conſider that the *Number* required in the queſtion is the Intereſt or Gain of 75 *l.* therefore that *Number* in the Suppoſition which hath the ſame name (*viz.* 6 *l.* which is the In-tereſt or Gain of 100 *l.*) muſt be the ſecond *Number* in the firſt Operation, and either 100 or 12 (it matters not which) muſt be the firſt *Number*; but I will take 100, and then for the third *Number*, I put that *Num-ber* in the Demand which hath the ſame Denomina-tion with 100, which is 75, (for they both ſignifie pounds principal) and then the *Numbers* will ſtand as you ſee in the Margent.

100—6—75

But if I had for the firſt *Number* put the other *Number* in the Suppoſition, *viz.* 12, which ſignifieth 12 Months, then the third *number* muſt have been 9, which is that *Number* in the Demand which hath the ſame Denomination with the firſt, *viz.* 9 Months, and then they will ſtand in the Margent.

10——6——9

There yet remain two *Numbers* to be diſpoſed of and thoſe are, one in the Suppoſition, and another in the Demand; that which is of the Suppoſition, I place under the firſt of the three *Numbers*, and the other which is in the Demand I place under the third *number*, and then 2 of the *terms* in the ſuppoſition will ſtand (one over the other) in the firſt place, and the 2 *terms* in the Demand will ſtand (one over the other) in the third place, as in the Margent.

100——6——75
12 9

Or thus,

12——6——9
100 75

8. Having diſpoſed, or ordered the *numbers* given according to the laſt Rule, we may proceed to a Reſolution, and firſt I work with the three uppermoſt *Numbers*, which according to the firſt diſpoſition are 100, 6, and 75, which is as much as to ſay, If 100 *l.* require 6 *l.* (Intereſt) how much will 75 *l.* require which by the third Rule of the eleventh Chapter I find to be *Di ect*, and by the 7 and 8 Rules of the tenth Chap. I find the fourth *Proportional number* to be 4 *l.* 10 *s.* ſo that by the foregoing ſingle Queſtion I have diſcovered how much Intereſt 75 *l.* will gain in 12 mon.; the operation whereof followeth on the left hand under the letter *A*; and having diſcovered how much 75 *l.* will gain in 12 Months, we may by another Queſtion eaſily diſcover how much it will gain in 9 months, for this fourth *number* (thus found) I put in the middle between the two loweſt *numbers* of the five after they are placed according to the ſeventh Rule of this Chapter; and then it will be a ſecond *number*, in another Queſtion in the Rule of Three

m. l. s. m.
the *numbers* being 12 4 10 9 the firſt and third

mbers being of one Denomination, *viz.* both Months, nd may be thus expreſſed, if 12 months require 4 *l.* 0 *s.* Intereſt, what will 9 months require? And by e third Rule of the 11*th* Chapter I find it to be the *irect* Rule, and by working according to the directions id down in the 7, 8, and 9 Rules of the 10*th.* Chaper, I find the fourth *Proportional number* to the laſt ſinle Queſtion to be 3 *l.* 07 *s.* 06 *d.* which is the ſixth *roportional number* to the 5 given *numbers*, and is the nſwer to the general Queſtion. The work of the laſt ngle Queſtion is expreſſed on the Right ſide of the ge under the Letter *B*, as followeth,

```
                100——6——75
           A       12          9        B
  l.       l.      l.  |        Then ſay,
 100 ——6——75           |    m.     l.     s.     m.
           75          | If 12——4——10——9
          ———          |           20
           30          |          ———
           42          |           90 ſhillings.
          ———l.  s.    |           12
 1|00) 4|50 (4--10     |          ———
                       |           180
           4           |           90
          ———          |          ————
 Rem. (50)             |           1080 pence
 Mult.  20             |          ———— 12) 2|0) l. s. d
        ———            |              9
 1|00)10|00(10s.       |      12) 9720 (810(6|7(3--7--5
                       |
                       |           96     72
         l.      s.    |          ———    ———
  Facit 4——10          |           12     90
                       |           12     84
                       |          ———    ———
                       |           (0)   (6) pence
                       |
                       |           l.     s.     d.
                       |   Facit 3——7——6
```

So that by the foregoing Operation I conclude that if 100 *l.* in 12 months gain 6 *l.* Intereſt, 75 *l.* will gain 3 *l.* 7 *s.* 6 *d.* in 9 months; after the ſame rate.

The Anſwer would have been the ſame, if the 5 given *Numbers* had been ordered according to the ſecond Method, *viz.* as you ſee in the Margent.

12—6—9
100 75

For firſt, I ſay, if 12 months gain 6 *l.* what will 9 months gain? This Queſtion I find to be *Direct* by th 3*d.* Rule of the 11*th.* Chapter, and by the 7 and 8 Rules of the 10*th* Chapter, I find the fourth *Proportional Number* to theſe three to be 4 *l.* 10 *s.*

Thus have I found out what is the Intereſt of 100 *l.* for 9 months, and I am now to find the Intereſt o 75 *l.* for 9 months; to effect which, I make this 4*th* *Number* (found as before) to be my ſecond *Number* in the next Queſtion, and ſay, If 100 *l.* require 4 *l.* what will 75 require? This Queſtion I find (b the ſaid third Rule of the eleventh Chapter) to b *Direct*, and by the ſaid 7*th*, 8*th*, and 9*th* Rules o the tenth Chapter, I find the Anſwer to be as before *viz.* 3 *l.* 7 *s.* 6 *d.*

This Rule hath been ſufficiently explained by th foregoing Example, ſo that the Learner may be abl to reſolve the following (or any other) Queſtions per tinent to the double Rule of 3 *Direct*, whoſe Anſwe are there given, but the Operation purpoſely omitte to try the Learners ability in the knowledge of wh hath been before delivered.

Queſt. 2. A ſecond Example in this Rule may be a followeth, *viz.* a Carrier receiving 42 ſhillings for th Carriage of 300 weight 150 Miles, I demand how muc he ought to receive for the Carriage of 7 *C.* 3 *qr* 14 *l.* 50 miles at that rate? *Anſwer*, 35 *s.* 9 *d.*

Queſt. 3. A Regiment of 936 Soldiers eat up 35 quarters of Wheat in 168 Days, I demand how man quarters of Wheat 11232 Soldiers will eat in 56 Da at that rate? *Anſwer*, 1404 *qrs.*

Queſt. 4. If 40 Acres of Graſs be mowed by 8 me in 7 Days, how many Acres ſhall be mowed by 24 me in 28 days? *Anſwer*, 480 Acres.

Queſ

Queſt. 5. If 48 Buſhels of Corn (or other ſeed) yield 6 Buſhels in 1 Year, how much will 230 Buſhels eld in 6 years at that rate? That is to ſay, if there re ſowed 240 Buſhels every one of the 6 years? *ſwer*, 17280 Buſhels.

Queſt. 6. If 40 ſhillings is the Wages of 8 Men for days, what ſhall be the Wages of 32 men for 24 ys? *Anſwer*, 768 ſhillings, or 38 *l.* 8 *s.*

Queſt. 7. If 14 Horſes eat 56 Buſhels of Provender 16 Days, how many Buſhels will 20 Horſes eat in Days? *Anſwer*, 120 Buſhels.

Queſt. 8. If 8 Cannons in 1 Day ſpend 48 Barrels Powder, I demand how many Barrels 24 Cannons ll ſpend in 22 days at that rate? *Anſwer*, 1728 rrels.

Queſt. 9. If in a Family conſiſting of 7 Perſons ere are drunk out 2 Kilderkins of Beer in 12 days, w many Kilderkins will there be drunk out in 8 days another Family conſiſting of 14 Perſons? *Anſwer*, Gallons, or 2 Kilderkins and 12 Gallons.

Queſt. 10. An *Uſurer* put 75*l.* out to receive Intereſt r the ſame, and when it had continued 9 Months, he ceived for Principal and Intereſt 78 *l.* 7 *s.* 6 *d.* I deand at what rate *per Cent. per Annum*, he received tereſt? *Anſwer*, at 6 *l. per Cent. per Annum.*

CHAP. XIII.

The Double Rule of Three Inverſe.

THE Double Rule of 3 *Inverſe*, is, when a Queſtion in the Double Rule of 3 is reſolved by 2 Single ules of 3, and one of thoſe Single Rules falls out to *Inverſe*, or requires a fourth *number* in *Proportion Re- procal* (for both the Queſtions are never *Inverſe*.)

2. In all Queſtions of the Double Rule of 3 (as well *verſe* as *Direct*,) you are (in the diſpoſing of the 5 given

numbers)to obſerve the ſeventh Rule of the 12*th* Chapter, and in reſolving of it by two ſingle Rules, obſerve to make Choice of your *Numbers* for the firſt, and ſecond, ſingle Queſtions according to the directions given in the eighth Rule of the ſame Chapter, as in the Example following, *viz.*

Queſt. 1. If 100 *l.* Principal in 12 Months gain 6 *l.* Intereſt, what Principal will gain 3 *l.* 7 *s.* 6 *d.* in 9 months?

This Queſtion is an Inverſion of the firſt Queſtion of the 12*th* Chapter,and may ſerve for a proof thereof.

In order to a Reſolution, I diſpoſe of the 5 given *Numbers* according to the 7*th* Rule of the laſt Chapter, and being ſo diſpoſed, will ſtand as followeth,

12 ——— 100 ——— 9
6 l. s. d.
3—7—6

Or thus,

l. s. d.
6 ——— 100 ——— 3—3—6
12 9

Here obſerve, that according to the eighth Rule of the twelfth Chapter, the firſt Queſtion, if you take it from the 5 *Numbers*, (as they are ordered or placed firſt) will be, If 12 months require 100 *l.* Principa what will 9 months require to make the ſame Intereſt? This (according to the third Rule of the 1 Chapter) is *Inverſe*, and the anſwer will be found (b the 2 Rule of the 11*th* Chapter) to be 133 *l.* 6 *s.* 8 the ſecond queſtion then will be, If 6 *l.* Intereſt, require 133 *l.* 6 *s.* 8 *d.* Principal, how much Principa will 3 *l.* 7 *s.* 6 *d.* require? This is a direct Rule,and th Anſwer in a direct *Proportion* is 75 *l.* See the Work.

Fir

Firſt I ſay,

```
    m.     l.      m.
If 12 ——— 100 ——— 9
           12
        ———————  l.   s.   d.
     9) 1200 (133 — 6 — 8
        . . .
         9            l.    s.   d.
       —————   facit 133 — 6 — 8
         30
         27
       —————
         30
         27
       —————
         (3)
          20
       —————
      9) 60 (6 s.
          54
       —————
         (6)
          12
       —————
      9) 72 (8 d.
          72
       —————
         (0)
```

Then I ſay,

	l.	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
If	6	133	6	8	3	7	6
	240	20		20			
	1440 *d.*	2666		67			
		12		12			
		5340		140			
		2666		67			
		3200		810 *d.*			
		810					
		320000					
		256					

144|0) 2592000 (18000 *d.* or 75 *l.*

144

1152

1152

(0)

So that by the foregoing Work I find that if 6 *l.* Intereſt be gained by 100 *l.* in 12 months, 3 *l.* 7 *s.* 6 *d.* will be gained by 75 *l.* in nine months.

But if the reſolution had been found out by the Numbers as they are ranked in the ſecond place, then the ſecond Queſtion in the ſingle Rule would have been *Inverſe*, and the firſt Queſtion *Direct*, and the concluſion the ſame with the firſt Method, *viz.* 75 *l.*

Queſt. 2. If a Reigment conſiſting of 936 Soldiers can eat up 351 quarters of Wheat in 168 days, how many Soldiers will eat up 1404 quarters in 56 days at that rate? *Anſwer*, 11232 Soldiers.

Queſt. 3. If 12 Students in 8 Weeks ſpend 48 *l.* I demand how many Students will ſpend 288 *l.* in 1 Weeks? *Anſwer*, 32 Students.

Queſt. 4. If 48 *l.* ſerve 12 Students 8 Week, how nany Weeks will 288 *l.* ſerve 4 Students? *Anſwer* 144 Weeks.

Queſt. 5. If when the Buſhel of Wheat coſt 3 *s.* 4*d.* he peny Loaf weigheth 12 ounces, I demand the eight of the Loaf worth 9 *d.* when the Buſhel coſt 0 *s.* *Anſwer* 35 *ounces.*

Queſt. 6. If 48 Pioneers in 12 days caſt a Trench 4 *yards* long, how many Pioneers will caſt a Trench 58 *yards* long in 16 days? *Anſwer* 252 Pioneers.

Queſt. 7. If 12 *C.* weight being carried 100 mile oſt 5 *l.* 12 *s.* I deſire to know how many *C.* weight hay be carried 150 miles for 12 *l.* 2 *s.* at that rate? *nſwer*, 18 *C.*

Queſt. 8. If when Wine is worth 30 *l. per Tun*, 20 ounds worth is ſufficient for the ordinary of 100 len, how many men will 4 *l.* worth ſuffice when it worth 24 *l. per Tun?* *Anſwer* 25 men.

Queſt. 9. If 6 men in 24 days mow 72 Acres, in ow many days will 8 men mow 24 Acres? *Anſwer*, 6 days

Queſt. 10. If when the Tun of Wine is worth 30 *l.* oo Men will be ſatisfied with 20 *l.* worth, I deſire know what the Tun is worth, when 4 *l.* worth will tisfie 25 men at the ſame rate? *Anſwer*, 24 *l. per Tun.*

CHAP. XIV.

he Rule of Three compoſed of five Numbers.

THE Rule of Three Compoſed, is, when Queſtions (wherein there are 5 Numbers given to nd a 6th in Proportion thereunto) are reſolved by one ngle Rule of 3 compoſed of the 5 given Numbers.

2. When Queſtions may be performed by the doue Rule of 3 Direct; and it is required to reſolve em by the Rule of 3 compoſed, (firſt order or rank our Numbers according to the 7th. Rule of the 12th hapter, then)

The Rule is,

Multiply the Terms or (Numbers) that ſtand one over the other, in the firſt place, the one by the other, and make their Product the firſt Term in the Rule of Three Direct, then multiply the Terms that ſtand one over the other in the third place, and place their Product for the third Term in the Rule of Three Direct, and put the middle Term of the Three uppermoſt for a ſecond Term; then having found a fourth Proportional, direct to theſe Three, this fourth Proportional ſo found, ſhall be the Anſwer required.

So the firſt Queſtion of the 12*th* Chapter being propoſed, *viz.* If 100 *l.* in 12 Months gain 6 *l.* Intereſt, what will 75 *l.* gain in 9 Months? The Numbers being ranked (or placed) as is there directed and done.

Then I multiply the two firſt Terms, 100 and 12, the one by the other, and their Product is 1200 (for the firſt Term;) then I multiply the two laſt Terms 75 and 9 together, and their Product is 675 for the third Term. Then I ſay, as 1200 is to 6, ſo is 675 to the Anſwer, which by the Rule of Three Direct will be found to be 3*l.* 7*s.* 6*d.* as was before found.

3. But if the Queſtion be to be anſwered by the double Rule of Three Inverſe, then having (placed the five given Terms as before) multiply the lowermoſt Term of the firſt place, by the uppermoſt Term of the third place, and put the Product for the firſt Term; then multiply the uppermoſt Term of the firſt place, by the lowermoſt Term of the third place, and put the Product for the third time, and put the ſecond Term of the three higheſt Numbers for the middle Term to thoſe two, then if the Inverſe Proportion is found in the uppermoſt three numbers, the 4*th* Proportional Direct to theſe three ſhall be the anſwer; ſo the firſt Queſtion of the 13*th* Chapter being ſtated, *viz.* If a 100 *l.* Principal in 12 Months gain 6 *l* Intereſt, what Principal will gain 3 *l.* 7 *s.* 6 *d.* in 9 Months? State the Numbers as is there directed in the firſt order, *viz.*

M. *l.* *M.*
12————100————9
l. *l.* *s.* *d.*
6 3——7——6

then reduce the 6 *l.* and 3 *l.* 7 *s.* 6 *d.* into pence, the 6 *l.* is 1440 *d.* and 3 *l.* 7 *s.* 6 *d.* is 810 *d.* then multiply 1440 by 9, the Product is 12960 for the firſt Term in the Rule of Three Direct, and multiply 810 by 12, the Product is 9720 for the third Term, then I ſay, As 12960 is to 130 *l.* ſo is 9720 to the Anſwer, *viz.* 75 *l.* as before. But if the *terms* had been placed after the ſecond order, *viz.*

l. *l.* *l.* *s.* *d.*
6————100————3——7——6
M *M.*
12 9

then the Inverſe Proportion is found in the loweſt Numbers, and having compoſed the Numbers for a ſingle Rule of Three as in the ſecond Rule foregoing, then the Anſwer muſt be found by a ſingle Rule of Three Inverſe, for here it falls out to multiply 810 by 12 for the firſt Number, and 1440 by 9 for the third Number, and then you muſt ſay, as 9720 is to 100 *l.* ſo is 12960 to the Anſwer, which by Inverſe Proportion will be found to be 75 *l.* as before.

The Queſtions in the 12*th* and 13*th* Chapters may ſerve for thy farther experience.

CHAP. XV.

Single Fellowſhip.

1. FELLOWSHIP is that Rule of Plural Proportion, whereby we ballance Accompts de-

pending between divers Perſons having put together a general Stock, ſo that they may every man have his Proportional part of Gain, or ſuſtain his Proportional part of Loſs.

2: The Rule of Fellowſhip is either ſingle, or it is double.

3. The ſingle Rule is when the Stocks propounded are ſingle Numbers without any reſpect or relation to time, each Partner continuing his Mony in Stock for the ſame time.

4. In the ſingle Rule of Fellowſhip, the Proportion is, as the whoſe Stock of all the Partners, is in Proportion to the total Gain or Loſs, ſo is each Mans particular ſhare in the Stock, to his particular ſhare in the Gain or Loſs. Therefore take the Total of all the Stocks for the firſt Term in the Rule of Three, and the whole Gain or Loſs for the ſecond Term, and the particular Stock of any one of the Partners for the third Term, then multiply and divide according to the 7th Rule of the 9th Chapter, and the 4th Proportional Number is the particular loſs or gain of him whoſe Stock you made your ſecond number, wherefore repeat the Rule of 3 as often as there are particular Stocks, or Partners in the queſtion, and the 4th Terms produced upon the ſeveral Operations are the reſpective Gain or Loſs of thoſe particular Stocks given, as in the Examples following.

Queſt. 1. Two Perſons, *viz.* A and B bought a Tun of Wine for 20 *l.* of which A paid 12 *l.* and B paid 8 *l.* and they gained in the Sale thereof 5 *l.* now I demand each Mans ſhare in the Gains according to his Stock?

Firſt, I find the Sum of their Stocks, by adding them together, *viz.* 12 *l.* and 8 *l.* which are 20 *l.* then according to this Rule I ſay firſt, If 20 *l.* (the Sum of their Stocks) Require 5 *l.* the total Gain, how much will 12 *l.* (the Stock of A) require? Multiply and Divide by the ſeventh Rule of the ninth Chapter, and the Anſwer is 3 *l.* for the ſhare of A in the gains;

$$\begin{array}{r} 12 \\ 8 \\ \hline 20\ l. \end{array}$$

gains; then again I ſay, If 20 *l.* require 5 *l.* what will 8 *l.* require? The Anſwer is 2 *l.* which is the *gain* of B. So I conclude that the ſhare of A in the gain is 3 *l.* and the ſhare of B in the gain is 2 *l.* which in all is 5 *l.*

l. l. l.
If 20——5——12
12
———
20) 60 (3 l.
60
———
(0)

Percival

[illegible]

l. l. l.
If 20——5——8
8
———
20) 40 (2 l.

Queſt. 2. Three Merchants, *viz.* A, B, and C, enter upon a joint Adventure, A put into the common ſtock 78 *l.* B put in 117 *l.* and C put in 234 *l.* and they find (when they make up their Accompts) that they have gained in all 264 *l.* now I deſire to know each Mans particular ſhare in the gains?

Firſt I add their particular ſtocks together, and their Sum is 429 *l.* then ſay, If 429 *l.* gain 264 *l.* what will 78 *l.* gain? and what 117 *l.* and what will 234 *l.* (the Stocks of A, B, and C.) gain? Work by 3 ſeveral Rules of 3, and you will find that

l.
78
117
234
———
ſum 429

			l
The Gain of	A	is	48
	B		72
	C		144
		Sum	264

Queſt. 3. Four Partners, *viz.* A, B, C, and D, between them built a Ship which coſt 1730 *l.* of whic A paid 346 *l.* B 519 *l.* C 692 *l.* and D 173 *l.* and hee Freight for a certain Voyage is 370 *l.* which is due t the owners, or Builders, I demand each Mans ſhar therein according to his Charge in Building her.

Anſwer,

	l.
A	74
B	111
C	148
D	37
Sum	370

Queſt. 4. A, B, and C, enter Partnerſhip for a ce tain time, A put into the common ſtock 364 *l.* B pu in 482 *l.* C put in 500 *l.* and they gained 867 *l.* noo I demand each mans ſhare in the gain Proportionab to his Stock.

Anſwer,

	l.	s.	d.
A	234	09	$3\frac{354}{1345}$
B	310	09	$4\frac{62}{1346}$
C	322	01	$3\frac{930}{1346}$
Sum	867	00	0

The Proof of t Rule of Sing Fellowſhip.

5. To prove the Rule of *Single Fellowſhip,* add ea mans *Particular* gain or loſs together, and if the total Sum is equal to the general gain or loſs, then is the Work rightly performed, but otherwiſe it is erroneous. Example, in the firſt Queſtion of this Chapter, the A *ſwer* was that the gain of A was 3 *l.* and the gain of 2 *l.* which added together make 5 *l.* equal to the to gain given.

If in finding out the *particular ſhares* of the ſeveral *rtners*, any thing remain after Diviſion is ended, h remainders muſt be added together, (they beg all Fractions of the ſame Denomination) and their n divided by the common Diviſor in each Queſtion z. the total ſtock) and the quotient add to the *parular gains*, and then if the total Sum is equal to the otal gain the work is right, otherwiſe not.

As in the fourth Queſtion, the Remainders were 4, 62, and 930, which added together make 1346, ich divided by 1346, (the Sum of their Stocks) Quotient is 1 *d*. which I add to the pence, &c. d the ſum of their ſhares is 867 *l*. equal to the total in ; wherefore I conclude the work is right.

CHAP. XVI.

Double Fellowſhip.

DOUBLE Fellowſhip is when ſeveral Perſons enter into *Partnerſhip* for unequal time, that is en every Mans *particular* ſtock hath relation to a *rticular* time.

2. In the double Rule of Felloſhip, multiply each *rticular* ſtock by its reſpective time, and having added the ſeveral products together make their ſum the ſt *number* (or *term*) in the Rule of 3, and the total n or loſs the ſecond number,and the product of any es particular ſtock by his time, the third *term*, and 4*th*. *number* in *Proportion* thereunto is his *particular* n or loſs, whoſe product of ſtock and time is your rd *number*.

Then repeat (as in Single Fellowſhip) the Rule of as often as there are Products or (Partners) and 4 *terms* thereby invented are the *numbers* required.

ample.

Queſt. 1. A and B enter *Partnerſhip*, A put in 40 *l*. 3 months, B put in 75 *l*. for 4 months, and they gained 70 *l.* now I demand each mans ſhare in th gains, proportionable to his ſtock and time? *Anſwer* A 20 *l.* B. 50 *l.*

To reſolve this Queſtion, I firſt multiply the ſtock of A, (*viz.* 40 *l.*) by its time (3 months) and the product is 120, then I multiply the ſtock of B by its time (*viz.* 75 by 4) and it produceth 300, which I add to the Product of A his Stock and Time, and the ſum is 420. Then by the Rule of 3 Direct, I ſay; As 400 (the Sum of the products) is to 70 (the total gain) ſo is 120 (the Product of A his ſtock and time) to 20 *l.* (the *ſhare* of B in the gains.) And ſo much ought each to have for his ſhare.

	l.		l.
	40		75
	3		4
A	120	B	300
			120
		Sum	420

Queſt. 2. A, B, and C, make a Stock for 12 Months; A put in at firſt 364 *l.* and 4 Months after that he pu in 40 *l.* B put in at firſt 408 *l.* and at the end of Months he took out 86 *l.* C put in at firſt 148 and 3 Months after he put in 86 *l.* more, and 5 month after that he put in 100 *l.* more, and at the end of 1 Months their gain is found to be 1436 *l.* I deſire t know each mans *ſhare* in the gains according to hi ſtock and time?

Firſt, I conſider, that the whole time of thei *Partnerſhip* is 12 Months. Then I proceed to find ou the ſeveral products or ſtock and time as followeth.

A had at firſt 364 *l.* for 4 Months, wherefore their Product is	1456
Then he put in 40 *l.* which with the firſt Sum makes 404 *l.* which continued the remainder of the time, *viz.* 8 Months, and their Product is	3232
The Sum of the products of the ſtock and time of A is	4688

B ha

B had 408 l. in 7 months, whoſe roduct is	2856
And then took out 86 l. therefore left in Stock 322 l. which conti- ied the reſt of the time, *viz.* five onths, whoſe product is	1610
The ſum of the products of the ock and time of B is	4466
C put in 148 l. for 3 months, whoſe oduct being multiplyed is	444
Then he put in 86 l. which added the firſt (*viz.* 148) makes 234 l. ich lay in ſtock 5 Months their oduct is	1170
Then he put in 100 l. more, ſo then had in ſtock 334 .l which continu- the Remainder of the time (*viz.* nonths) which multiplyed together oduce	1336
The Sum of the product of the mo- and time of C is	2950
B	4466
A	4688
The Total Sum of all the product	12104

Then I ſay, as 12104 is to 1436 (the total gain) ſo 2950, to the *ſhare* of A in the gains, *&c.* go on as he foregoing Examples, and you will find their es in the gain to be as followeth, *viz.*

Anſwer,

			l.	s.	d.
The ſhare of	A	is	556	03	$6\frac{6192}{12104}$
	B		529	16	$9\frac{5496}{12104}$
	C		349	19	$1\frac{416}{12104}$
			1436	00	0

Queſt. 3. Three Graſiers, A, B, and C, take a piec
of ground for 46 l. 10 s. in which A put in 12 Oxe
for 8 Months, B put in 16 Oxen for 5 months, and
put 18 Oxen for 4 Months, now the queſtion is, wha
ſhall each man pay of the 46. l. 10 s. for his ſhar
in that charge?

Anſwer,

		l.	s
A	ſhall pay	18	00
B		15	00
C		13	10
		46	10

3. The proof of this Rule is the ſame with that o
Single Fellowſhip, laid down in the 5*th.* Rule of the 5t
Chapter; and note that,

If a loſs be ſuſtained inſtead of gain amongſt *Par*
ners, every mans ſhare to be born in the loſs, is to t
found after the ſame method as their gain, wheth
their Stocks be for equal or unequal time.

CHAP. XVII.

Alligation Medial.

1. THE Rule of Alligation is that Rule in plur
proportion, by which we reſolve queſtion
wherein is a compoſition or mixture of divers ſimple
as alſo it is uſeful in the compoſition of Medicines bo
for quantity, quality, and price. And its ſpecies a
two, *viz.* Medial and Alternate.

2. Alligation Medial is when having the ſever
quantities and prices of ſeveral ſimples propounde
we diſcover the mean price or rate of any quanti
of the mixture compounded of thoſe ſimples, an
the proportion is,

As the ſum of the ſimples to be mingled is to the total value of all the ſimples, ſo is any part or quantity of the Compoſition or mixture, to its mean Rate or Price.

Queſt. 1. A Farmer mingleth 20 buſhels of VVheat at 5 *s. per* buſhel, and 36 buſhels of Rye at 3 *s. per* buſhel, with 40 buſhels of Barley, at 2 *s. per* buſhel, now I deſire to know what one buſhel of that mixture is worth?

To reſolve this Queſtion add together the given quantities and alſo their values, which is 96 buſhels, whoſe total value is 14 *l.* 8. *s.* as appeareth by the VVork following, for

buſh.			*l.*	*d.*
20 *of Wheat at*	5 s. per *Buſhel, is*		5—	0
36 *of Rye at*	3 s. per *Buſhel, is*		5—	3
40 *of Barley at*	2 s. per *Buſhel, is*		4—	0
The Sum of the given quantities is	96	*and their value is*	14—	8

Then ſay by the Rule of 3 *Direct*, If 96 Buſhels coſt (or is worth) 14 *l.* 8 *s.* what is 1 *Buſhel* worth?

b. l. s. b:
96——14——8——1
20

96) 288 (3 *s.*
288
(0)

facit 3 *s. per Buſhel*

Queſt. 2. A Vinter mingleth 15 Gallons of Canary at 8 *s. per* gallon, with 20 gallons of Malaga at 7 *s.* 4*d. per* gallon, with 10 gallons of Sherry at 6 *s.* 8*d. per* gallon, and 24 gallons of VVhite-wine at 4 *s. per* gallon, now I demand what a gallon of that Mixture is worth? work as in the laſt Queſtion, and you will find the Anſwer to be 6 *s.* 2 *d.* 2 *qurs.* $\frac{45}{69}$.

Queſt. 3. A Grocer hath mingled 3 C. of Sugar a 56 *s. per C.* with 3 *C.* of Sugar at 3 *l.* 14 *s.* 08 *d. pe* *C.* and with 6 C. at 1 *l.* 17 *s.* 04 *d. per C.* I defir to know the price of a hundred weight of that mixture? *Anſwer* 2 *l.* 13 *s.* 1 *d.* $\frac{7}{13}$.

The Proof of Allig. Medial.

3. The proof of this operation is by the price o any quantity of the mixture to fin out the total value of the whole compoſition, and if it is equal to th total value of the ſeveral ſimples, the Work is right, otherwiſe not. As in the firſt Example, the anſwer to the queſtion was that 3 *s.* is th price of one buſhel, wherefore I ſay by the Rule o Proportion, If 1 buſhel be 3 ſhillings, what is 96 buſhe *Anſwer* 14 *l.* 8 *s* which is the total value of the ſeveral ſimples, wherefore the Work is right.

CHAP. XVIII.

Alligation Alternate.

1. Alligation Alternate is when there are given the particular prices of ſeveral ſimples, and thereby we diſcover ſuch quantities of thoſe ſimples, as being mingled together ſhall bear a certain rate propounded.

2. When ſuch a queſtion is ſtated, place the given prices of the ſimples one over the other, and the propounded price of the compoſition againſt them in ſuch ſort that it may repreſent a Root, and they ſo many branches ſpringing from it as in the following Example.

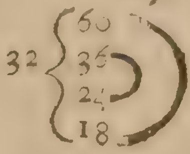
Queſt. 1. A certain Farmer is deſirous to mix 20 buſhels of Wheat at 5 *s.* or 60 *d. per* buſhel, with Rye at 3 *s.* or 36 *d. per* buſhel, and with Barley at 2 *s.* or 24 *d. per* buſhel, and Oats at 1 *s.* 6 *d. per* buſhel, and deſireth to mix ſuch a quantity of Rye, Barly and Oats with the 20 buſhels of Wheat, as that the whole compoſition may be worth 2 *s.* 8 *d.* or 32 *d. per* buſhel.

The prices of the ſimples being placed according to the laſt Rule, with the price of the compoſition propounded as a root to them will ſtand as followeth.

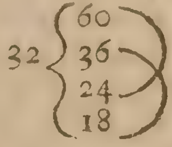
$$32\left\{\begin{array}{l}60 \textit{ pence}\\ 36\\ 24\\ 18\end{array}\right.$$

3. Having thus placed the given Numbers you are, to link or combine the ſeveral rates of the ſimples the one to the other, by certain Arches, in ſuch a ſort that one that is leſſer than the root (or mean rate) may be linked or coupled to another that is greater than the mean rate, ſo the queſtion laſt propounded will ſtand.

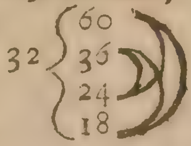
1. *Thus)*



2. *Or thus,*

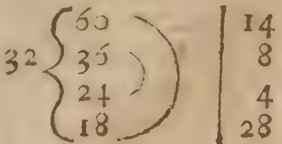


3. *Or thus,*



4. Then take the difference between the root and the ſeveral branches, and place the difference of each againſt the number or branch, with which it is coupled or linked, and having taken all the Differences and placed them as aforeſaid, then thoſe differences ſo placed will ſhew you the number of each ſimple to be taken to make a compoſition to bear the mean rate propounded.

So the branches of the laſt queſtion being linked together as in the firſt manner, I ſay the difference between 32 and 60, is 28, which I put againſt 18, becauſe 60 is linked with 18, then the difference between 32 and 36 is 4, which I



put againſt 24, becauſe 36 is linked or coupled wit 24, then I ſay the difference between 32 and 24 is which I place againſt 36 (for the reaſon aforeſai then I ſay the difference between 32 and 18 is 1 which I place againſt 60; and then the Work wi ſtand as you ſee in the Margent.

So I conclude that a compoſition made of 14 buſhe of Wheat at 60 *d. per* buſhel, and 8 buſhels of Rye a 36 *d. per* buſhel, and 4 buſhels of Barley at 24 *d. pe* buſhel, and 28 buſhels of Oats at 18 *d. per* buſhe will bear the mean price of 32 *d.* or 2 *s.* 8 *d. pe* buſhel. And here obſerve that in this compoſitio there is but 14 buſhels of Wheat; but I would mingle 20 buſhels, and this kind (or rather caſe) of Alligation Alternate, (*viz.*) when there is given a certai quantity of one of the ſimples, and the quantities o the reſt ſought to mingle with this given quantity (that the whole may bear a price propounded) is called Alternation partial.

And the proportion to find out the ſeveral quantities to be mingled with the given quantity is as followeth, *viz.*

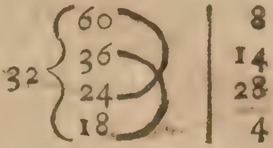
As the difference annexed to the branch that is th value of an Integer of the given quantity, is to th other particular Differences, ſo is the quantity give to the ſeveral quantities required.

So here, how to find out ſo much Rye, Barley an Oats muſt be mingled with the 20 buſhels of Wheat I ſay by the ſingle Rule of 3 Direct, If 14 buſhels o Wheat require 8 buſhels of Rye, what will 20 buſhel of Wheat require? *Anſwer*, $11\frac{6}{14}$ buſhels of Rye.

Again, if 14 buſhels of Wheat require 4 buſhels o Barley, what will 20 buſhels of Wheat require? *Anſwer* $5\frac{10}{14}$ buſhels of Barley. Again I ſay, if 14 buſhels o Wheat require 28 buſhels of Oats what will 20 buſhel of Wheat require? *Anſwer*, 40 buſhels of Oats.

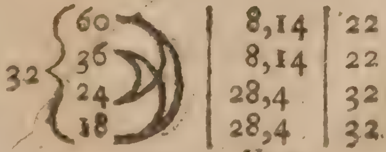
And now I ſay, that 20 buſhels of Wheat mingle with $11\frac{6}{14}$ buſhels of Rye, and $5\frac{10}{14}$ buſhels of Barley and 40 buſhels of Oats, each bearing the Rates as aforeſaid, will make a compoſition or heap of Corn tha may yield 32 *d. per* buſhel.

But if the branches had been coupled according to the ſecond order, or manner, the differences would have been thus placed, *viz.* the differences between 32 and 60 is 28, which I ſet againſt 24, becauſe 60 is linked thereto; and the difference between 32 and 36 is 4, which I ſet againſt 18, and the difference betwixt 32 and 24 is 8, which I ſet againſt 60; then the difference between 32 and 18 is 14, which I ſet againſt his yoke-fellow 36, and then I conclude that if you mix 8 buſhels of Wheat with 14 buſhels of Rye, 28 buſhels of Barley, and 4 buſhels of Oats, each bearing the foreſaid prices, the whole mixture may be ſold for 32 *d. per* buſhel, as by the work in the Margent.



You ſee by this work we have found how many buſhels of Rye, Barley and Oats, ought to be mixed with 8 buſhels of Wheat, and to find out how many of each ought to be mixt with 20 buſhels of Wheat, I ſay, as 8 is to 14, ſo is 20 to 35 buſhels of Rye. As 8 is to 28, ſo is 20 to 70 buſhels of Barley. As 8 is to 4, ſo is 20 to 10 buſhels of Oats, whereby I conclude, that if to 20 buſhels of Wheat I put 35 buſhels of Rye, 70 buſhels of Barley, and 10 buſhels of Oats, bearing each the foreſaid prices *per* buſhel, that then a buſhel of this mixture will be worth 32 *d.* or 2 *s.* 8 *d.*

And if the branches had been linked as you ſee in the third place, where each branch bigger than the root, is linked to two that are leſſer than the root, then in this caſe you muſt have placed the ſeveral differences between the root and branches, againſt thoſe two with which each is coupled, as firſt the difference between 32 and 60 is 28, which I put againſt 24 and 18 becauſe it is coupled,



with them both, then the difference between 32 and 36 is 4, which I ſet likewiſe againſt 24 and 18, becauſe 36 is linked to them both, then the difference between 32 and 24 is 8, which I put againſt 60 and 36, becauſe 24 is linked to them both, then the difference between 32 and 18 is 14, which I put againſt 60 and 36, the yoke-fellows of 18.

Laſtly, I draw a line behind the differences, and add differences which ſtand againſt each branch, and put the ſum behind the ſaid line againſt its proper branch as you ſee in the Margent.

And now by this work I find that 22 buſhels of the Wheat mingled with 22 buſhels of Rye, and 32 buſhels of Early, and 32 buſhels of Oats, each bearing the ſaid price will make a mixture, bearing the mean rate of 32 *d.* *per* buſhel.

And to find how much of each of the reſt muſt be mingled with 20 buſhels of Wheat, I ſay,

As 22 is to 22, ſo is 20 to 20 buſhels of Rye. As 22 is to 32, ſo is 20 to $29\frac{2}{22}$ buſhels of Early. As 22 is to 23, ſo is 20 to $29\frac{2}{32}$ buſhels of Oats.

Whereby you ſee the queſtions of Alligation Alternate will admit of more true anſwers than one: for we have found three ſeveral anſwers to this firſt queſtion.

The Proof of Alternation partial.

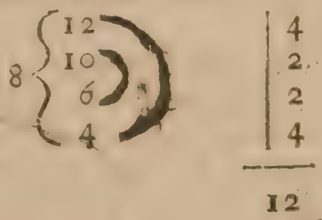
Queſtions of Alternation partial are proved the ſame way with Queſtions in Alligation medial which you may ſee in the 3*d* Rule of the 17*th*. Chapter.

Queſt. 2. A Grocer hath 4 ſorts of Sugar, *viz.* of 12 *d. per l.* of 10 *d. per l.* of 6 *d. per l.* and of 4 *d. per l.* and he would have a compoſition worth 8 *d. per l.* the whole Quantity whereof ſhould contain 144 *l.* made of theſe 4 ſorts, I demand how much of each he muſt take?

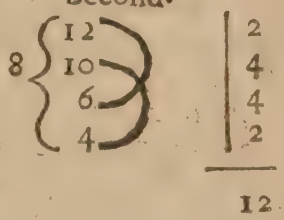
Queſtions of this Nature are reſolved by that part of Alligation alternate called by Arithmeticians Alternation total, *viz.* where there is given the ſum, and prices of ſeveral ſimples to find out how much of each ſimple ought to be taken to make the ſaid ſum or quantity, ſo that it may bear a certain Rate propounded.

To reſolve this queſtion I place the ſeveral prices of the ſimples and mean rate propounded, and link them together, as is directed in the 2 and 3 Rules of this Chapter, and place the differences between the root and branches according to the 4*th*. Rule of this Chapter, which will then ſtand one of theſe three ways, *viz.*

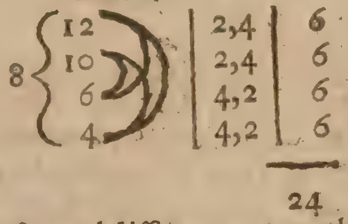
First.



Second.



Third.



5. Then add the ſeveral differences together, which I have done, and the ſums of the firſt and ſecond order are 12 *l.* and of the third 24 *l.* as you may ſee above, but it is required that there ſhould be 144 *l.* of the compoſition, therefore to find the quantity of each ſimple, to make the whole compoſition 144 *l.* obſerve this general Rule, *viz.*

As the ſum of the differences is to the ſeveral differences, ſo is the total quantity of the compoſition to the quantity of each ſimple.

So to find how much of each ſort of Sugar, I ought to take to make 144 *l.* at 8 *d. per. l.* I ſay,

l.

As 12 is to 4, ſo is 144 to 48 *l.* at 12 *d. per l.*
As 12 is to 2, ſo is 144 to 24 *l.* at 10 *d. per l.*
As 12 is to 2, ſo is 144 to 24 *l.* at 6 *d. per. l.*
As 12 is to 4, ſo is 144 to 58 *l.* at 4 *d. per. l.*

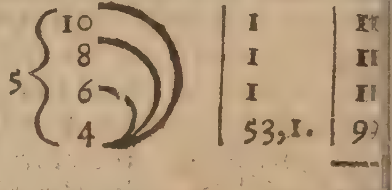
Whereby I find that 48 *l.* at 12 *d. per l.* and 24 *l.* at 10 *d. per l.* and 24 *l.* at 6 *d. per l.* and 48 *l.* at 4 *d. per l.* will make a compoſition of Sugar containing 144 *l.* worth 8 *d. per l.*

But as the branches are linked in the ſecond order the anſwer will be 24 *l.* at 12 *d. per l.* and 48 *l.* at 10 *d. per l.* and 48 *l.* at 6 *d. per l.* and 24 *l.* at 4 *d. per l.* to make the ſaid quantity, and to bear the ſaid price.

And if you had worked as the Branches are linked after the third order, then you would have found the quantity of 36 *l.* of each.

Queſt. 3. A Vintner hath 4 ſorts of Wine, *viz.* Canary at 10 *s. per* Gallon, Malaga at 8 *s. per* gallon; Rheniſh-wine at 6 *s. per* gallon; and White-wine at 4 *s. per* gallon, and he is minded to make a Compoſition of them all of 60 gallons that may be worth 5 ſhillings *per* Gallon, I deſire to know how much of each he muſt have?

The numbers or terms being ranked according to the ſecond Rule of this Chapter, the branches will be linked as followeth, and will admit of no other manner of coupling, becauſe there is but one branch that is leſſer than the Root, therefore all the reſt muſt be linked unto it; and the differences between the Root and the three firſt branches, *viz.* 10, 8, and 6, which are 5, 3, and 1, muſt be ſet againſt 4 becauſe they are all coupled with it, and the difference between the Root (*viz.* 5.) and 4, which is 1, muſt be ſet againſt the 3 other, becauſe it is linked to them all; ſo I find 1 gall. of Canary, 1 gallon of Malaga, 1 gallon of Rheniſh Wine, and 9 gallons of White-wine, prized as above being mingled together, will be worth 5 *s. per* gallon, the Sum being 12 gallons, but there muſt be 60 gallons, wherefore I ſay,



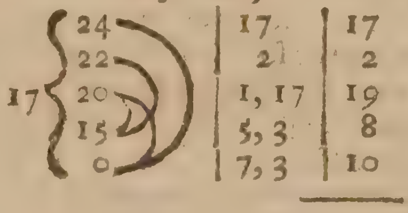
As 12 is to 1, ſo is 60 to 5 gallons of Canary.
As 12 is to 1, ſo is 60 to 5 gallons of Malaga.
As 12 is to 1, ſo is 60 to 5 gallons of Rheniſh.
As 12 is to 9, ſo is 60 to 45 gall. of White-wine.

So that 5 gallons of Canary, 5 gallons of Malaga, 5 gallons of Rheniſh, and 45 gallons of White-wine mingled together, will be in all 60 gallons, worth 5 *s.* er gallon, which was required.

Queſt. 4. A Goldſmith hath Gold of 4 ſeveral ſorts of fineneſs, *viz.* of 24 *Carects* fine, and of 22 *Carects* fine, of 20 *Carects* ine, and of 15 *Carects* fine. And he would mingle ſo much of each with alloy, that the whole Maſs of 18 ounces of Gold ſo mingled may bear 17 *Carects* ine. I demand how much of each he muſt take, the ſecond and third Rules of this Chapter being oberved, (for inſtead of the alloy I put 0, becauſe it bears no fineneſs, but it makes a branch in the Operaion) the terms may be alligated and the differences added any of theſe 4 ways following, *viz.*

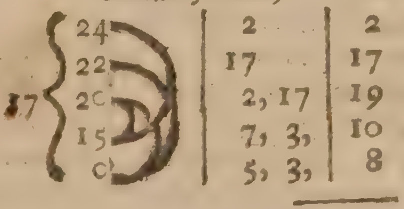
Read Chap. 2. def. 2. of this Book.

Firſt thus,



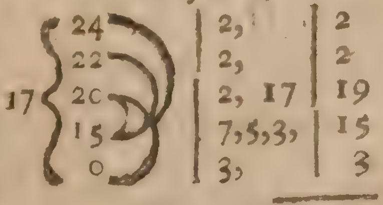
Sum 56

Secondly thus,



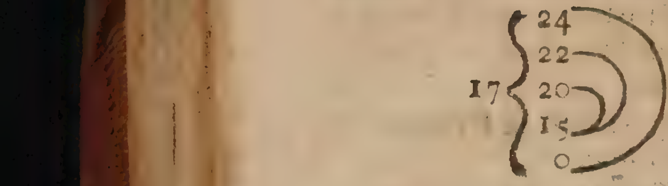
Sum 56

Thirdly thus,



Sum 41

Fourthly thus,



2,	17,	19
2,	17,	19
2,	17,	19
7,5	3	15
7,5	3	15
		Sum 87

More ways may be given for the Alligatin or linking of the *Terms* in this Queſtion, but theſe a ſufficient for the induſtrious, and it ſhall alſo ſuffi to give an anſwer to the queſtion as the terms a link'd the firſt way, not doubting but the ingenio practitioner will be able at his leiſure to find Anſwe to the other 3 ways, *viz.*

	oz.	*p.w.*	*car.*
As 56 is to 17, ſo is 28 to	8	10	of 24
As 56 is to 2, ſo is 28 to	10	00	of 22
As 56 is to 19, ſo is 28 to	9	10	of 20
As 56 is to 18, ſo is 28 to	4	00	of 15
As 56 is to 10, ſo is 28 to	5	00	of allo

Thus much well practiſed and underſtood is ſuf cient for the underſtanding of Alligation.

In queſtions of Alternation Total, the Anſwer given is true, when the ſum of each of the quantity of ſimples found, agrees with the Sum or Quantity propounded; as in the laſt Queſtion, th Anſwer was 8 *oz.* 10 *p. w.* of 24 Carects fine, 10 of 22 Carects fine, 9 *oz.* 10 *p. w.* of 20 Carects fin 4 *oz.* of 15 Carects fine, and 5 *oz.* of Alloy, which add together make 28 *oz.* the quantity propounded.

The proof of Alternation Total.

CHAP. XIX.

Reduction of Vulgar Fractions.

1. WHat a Vulgar Fraction is, and its parts a ſeveral kinds, hath been already ſhewed the 19, 20, 21, 22, 23, 24, and 31 definitions of t

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irſt Chapter of this Book, which the Learner is deſired diligently to obſerve before he proceeds.

2. To reduce a Vulgar Fraction (which diſcovereth he principal knowledge of Fractions, and therefore ought greatly to be regarded) we ſhall diſcover plainly under theſe eight ſeveral heads (or Rules) following, *viz.*

1. To reduce a mixt number into an improper Fraction.

2. To reduce a whole Number into an improper Fraction.

3. To reduce an improper Fraction into its equivalent whole (or mixt) number.

4. To reduce a Fraction into its loweſt terms equivalent to the Fraction given.

5. To find the value of a Fraction in the known parts of Coyn, Weight, Meaſure, *&c.*

6. To reduce a compound Fraction to a ſimple one of the ſame value.

7. To reduce divers Fractions having unequal denominators, to Fractions of the ſame value, having an qual Denominator.

8. To reduce a Fraction of one denomination to nother of the ſame value.

I. *To reduce a mixt Number to an improper Fraction.*

The Rule is,

Vide Chap. 1. *defin.* 31.

Multiply the Integral part (or whole Number) by he denominator of the Fraction, and to the Product dd the Numerator, and that Sum place over the Denominator for a new Numerator; ſo this new Fraction hall be equal to the mixt Number given. As for xample.

1. Reduce $18\frac{3}{7}$ into an improper Fraction, multiply he whole number 18 by 7 the denominator, and to the roduct add the numerator 3, the ſum is 129, which ut over the denominator 7, and it makes $\frac{119}{7}$ for the nſwer as followeth.

$18\frac{3}{7}$

$$\begin{array}{r} 18\frac{3}{7} \\ 7 \\ \hline 129 \end{array}$$

facit $\frac{129}{7}$

2. Reduce $183\frac{5}{21}$ to an improper *fraction, facit* $\frac{210}{1}$

3. Reduce $56\frac{13}{22}$ to an improper *fraction, facit* $\frac{118}{2}$

II. *To reduce a whole Numberto an improper Fractio*

The Rule is,

Multiply the given *Number*, by the intended *denominator*, and place the product for a *numerator* over it. As for *Example.*

Vide Chap. 11 *defin.* 23.

1. Let it be required to reduce 15 into aFractio whoſe denominator ſhall be 12. To effect which, I multiply 15 by the intended denominator (12) the product is 180, which I place over 12 as a numerator, and it makes $\frac{180}{12}$ which is equal to 15, as was required; as *per* Margent.

$$\begin{array}{r} 15 \\ 12 \\ \hline 30 \\ 15 \\ \hline 180 \end{array}$$

facit $\frac{180}{12}$

2. Reduce 36 into an improper Fraction who denominator ſhall be 26, *facit* $\frac{936}{26}$.

3. Reduce 135 into an improper Fraction, who denominator ſhall be 16, *facit* $\frac{2160}{16}$.

III. *To reduce an improper Fraction into its equivale whole or mixt number.*

The Rule is,

Divide the Numerator by the Denominator, ar the Quotient is the whole number equal to the fractio and if any thing remain, put it for a Numerator ov the Diviſor. Example,

1. Reduc

1. Reduce $\frac{436}{8}$ into its equivalent mixt number, ivide the Numerator 436 by the denominator 8, and e Quotient is 54, and 4 remains, which put for a umerator over the Diviſor 8, the Anſwer is $54\frac{4}{8}$ as olloweth.

8) 436 (54

40

facit $54\frac{4}{8}$ 36

32

4

2. Reduce $\frac{3476}{15}$ to a mixt number, *facit* $231\frac{11}{15}$

3. Reduce $\frac{15576}{136}$ to a mixt number *facit* $114\frac{72}{136}$

IV. *To Reduce a Fraction into its loweſt terms equivalent to the Fraction given.*

The Rule is,

1. If the *numerator* and *denominator* are even *numbers*, ake half of the one, and half of the other as often as ay be, and when either of them falls out to be an dd number, then divide them by any number that you n diſcover will divide both *numerator* and *denominar* without any Remainder; and when you have thus roceeded as low as you can reduce them, then this ew Fraction ſo found out ſhall be the *fraction* you eſire, and will be in value equal to the given Fraction. xample.

1. Let it be required to reduce $\frac{192}{336}$ into its loweſt erms. Firſt, I take e half of the *Numetor* 192 and it is 96, en half of the *Deminator* and it is 168, ſo that now it is brought to $\frac{96}{168}$, and next to $\frac{48}{84}$, and by halfing ſtill to $\frac{24}{42}$, and eir half is $\frac{12}{21}$, and now I can no longer half it, beuſe 21 is an odd *number*, wherefore I try to divide em by 3, 4, 5, 6, *&c.* and I find 3 divides them both ithout any remainder, and brings them to $\frac{4}{7}$ as *per* argent.

192	96	48	24	12	4
336	168	84	42	21	6

So I conclude $\frac{4}{7}$ thus found to be equal in value t the given *fraction* $\frac{192}{336}$.

2. What is $\frac{1036}{1184}$ in its loweſt terms? *Anſwer*

3. What is $\frac{1342}{1586}$ in its loweſt terms? *Anſwer* $\frac{1}{1}$

There is yet another way more excellent than th former to reduce a *fraction* into its loweſt terms, and that is by finding a common Meaſurer, *viz.* the greateſt *number* that will divide the *numerator* and *denominator* without any remainder, an by that means reduce a *fraction* to its loweſt terms a the firſt work; and to find out this common meaſure divide the *denominator* by the *numerator*, and if an thing remains divide your Diviſor thereby; and if an thing yet *remains*, then divide your laſt Diviſor by it do ſo until you find nothing *remains*; then this la diviſor ſhall be the greateſt common meaſurer, whic will divide both *numerator* and *denominator*, and reduc them into their loweſt terms at one Work.

Vide Ought. Cl. Matth. Cap. 7.

Example.

4. Reduce $\frac{228}{304}$ into its loweſt terms by a commo meaſurer. To effect which I divide the *denominat* 304 by the *numerator* 228 and there remains 76, the I divide 228 (the firſt Diviſor) by 76 (the *Remainde* and it quotes 3, and nothing *remains*; wherefore th laſt Diviſor 76 is the common meaſurer, by which divide the *numerator* of the given *Fraction*, *viz.* 22 it quotes 3 for a new *numerator*, then I divide the *de nominator* 304 by 76 and it quotes 4 for a new *den minator*, that now I have found $\frac{3}{4}$ equal to $\frac{228}{304}$.

5. Reduce $\frac{6048}{7392}$ into its loweſt terms by a commo meaſurer, *facit* $\frac{9}{11}$.

6. Reduce $\frac{3081}{20382}$ into its loweſt terms by a com mon meaſurer, *facit* $\frac{13}{86}$.

A Compendium.

Note that if the *numerator* and *denominator* of a *fra ction*, and each with a Cypher or Cyphers, then cu off as many Cyphers from the one as from the othe and the *remaining* figures will be a *fraction* of the ſam value, *viz.* $\frac{3400}{7200}$ will be found to be reduced to $\frac{3}{7}$

t

cutting off the 2 Cyphers from the *numerator* and *nominator*, with a daſh of the Pen, thus, $\frac{34|00}{71|00}$, d $\frac{460}{700}$, will be $\frac{46}{70}$ thus $\frac{46|0}{70|0}$, *&c.*

V. *To find the Value of a Fraction in the known parts of Coyn, Weight, &c.*

The Rule is,

Multiply the *numerator* by the parts of the next infe- our *denomination* that are equal to to an Unit of the ne *denomination* with the *Fraction*, then divide that oduct by the *denominator*, and the quote gives you its lue in the ſame parts you multipled by, and if any ng remain multiply it by the parts of the next in- iour *denomination*, and divide as before, do ſo till u can bring it no lower, and the ſeveral quotients ll give you the value of the *fraction* as was required, d if any thing at laſt remain, place it for a *numerator* er the former *denominator*, ſome few Examples will ke the Rule plain.

1. What is the value of $\frac{27}{29}$ *l. Sterling?* To anſwer s Queſtion I multiply the numerator 27 by 20 (the llings in a pound) the product is 540, which I di- le by 29 (the denominator) and the Quotient is *s.* and there remains 18 which I multiply by 12 nce, and the product (216) I divide by the denomi- tor 29, the Quotient is 7 *d.* and 13 remains, which nultiply by 4 Farthings, the product is 52, which till divide by 29, the Quotient is 1 Farthing, and re remaineth 23, which I put for a Numerator er the denominator 29, ſo I find the value of $\frac{27}{29}$ *l.* be 18 *s.* 7 *d.* 1 *qr.* $\frac{23}{29}$, as by the following Opera- n, and after the ſame manner are the values of the ctions in the ſeveral examples following found out.

$\frac{27}{29}$ *l.*
27
Multiply 20

29) 540 (18 *s.*
29

250
232

Remains (18)
Multiply 12

36
18

29) 216 (7 *d.*
203

Remains (13)
Multiply 4
qr.
(29 52 (1$\frac{13}{29}$
29

Remains (23)
s. *d.* *qr.*
Facit. 18—7—1$\frac{23}{29}$

2. VVhat is the value of $\frac{11}{15}$ *l. Sterling? facit* 14*s.*

3. VVhat is the Value of $\frac{28}{137}$ *l. Sterling? facit* 4
1 *d.* $\frac{7}{137}$.

4. VVhat is $\frac{16}{22}$ *C.* weight? *facit* 3 *qrs.* 1 *l.* 5 *oz.*

5. VVhat is $\frac{136}{131}$*l. Troy* weight? *facit* 4 *oz. p.* 23. *gr.* $\frac{179}{271}$.

6. VVhat is $\frac{41}{50}$ of a year? *Anſwer,* 299 *da.* 7. 12 *min.*

VI. *To Reduce a compound Fraction to a ſimple one of the ſame value.*

What a compound Fraction is, hath been ſhewed in ap. 1. Definition 24, and to reduce it to a ſimple ction of the ſame value.

The Rule is,

Multiply the Numerator continually, and place the t product for a new Numerator, then multiply the nominators continually, and place the laſt product a new denominator. So this ſingle Fraction ſhall be al to the compound Fraction given. Example.

1. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a ſimple Fraction.

Multiply the Numerators 2,3, and 5, together, they ke 30 for a new Numerator; then I multiply the nominators 3, 5, and 8 together, and their product 120 for a denominator, ſo the ſimple Fraction is $\frac{30}{120}$, and cutting off the Cyphers it is $\frac{3}{12}$ equal to $\frac{1}{4}$ the fourth Rule foregoing.

$$\begin{array}{cc} 5 & 3 \\ 3 & 2 \\ \hline 15 & 6 \\ 8 & 5 \\ \hline 120 & 30 \end{array}$$

Facit $\frac{30}{120}$ or $\frac{3}{12}$ or $\frac{1}{8}$.

2. What is $\frac{7}{10}$ of $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$? *Anſwer* $\frac{1540}{7560}$ or $\frac{154}{756}$ $\frac{77}{378}$ in its leaſt terms.

3. What is $\frac{11}{12}$ of $\frac{13}{14}$ of $\frac{21}{29}$? *Anſwer*, $\frac{3003}{4872}$.

By this you may know how to find the value of a mpound Fraction, *viz.* firſt reduce it to a ſimple , and then find out his value by the 5*th*. Rule fore- ng.

Example.

What is the value of $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ of a pound *Anſwer*, 11 *s.* 3 *d.*

VII. *To reduce Fractions of unequal Denominators Fractions of the ſame value, having equal Denom nators.*

The Rule is,

Multiply all the Denominators together, and th Product ſhall be the Common Denominator. The multiply each Numerator into all the Denominator except its own, and the laſt Product put for a Nu merator over the Denominator found out as before So this new Fraction is equal to that Fraction, whoſ Numerator you multiplyed into the ſaid Denomina tors. Do ſo by all the Numerators given, and yo have your deſire.

Example.

1. Reduce $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, and $\frac{7}{8}$ to a common Denomina tor Multiply the Denominators 4, 5, 6, and 8, togethe continually, and the product is 960 for the commo Denominator; then multiply the Numerator 3 into th Denominators, 5, 6, and 8, and the product is 720 which is a Numerator to 960 (found as before) ſo $\frac{72}{96}$ is equal to the firſt Fraction $\frac{3}{4}$, then I proceed to fin a new Numerator to the ſecond Fraction *viz.* $\frac{4}{5}$, and multiply 4 (into all the Denominators except its own *viz.*) into 4, 6, and 8, which produceth $\frac{768}{960}$ equal t $\frac{4}{5}$, then multiply the numerator 5 into the denomina tors 4, 5, and 8, the product is $\frac{800}{960}$ equal to $\frac{5}{6}$. The multiply the numerator 7 into the Denominators 4, 5 and 6, the product is $\frac{840}{960}$ equal to $\frac{7}{8}$, and the work i done; ſo that for $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{9}$ and $\frac{7}{8}$, I have $\frac{720}{960}$, $\frac{768}{960}$, $\frac{800}{960}$ $\frac{840}{960}$.

2. Reduce $\frac{11}{12}$, $\frac{14}{23}$, and $\frac{19}{21}$ into a common denomi nator, *faciunt* $\frac{5312}{5796}$, $\frac{3528}{5796}$, and $\frac{5244}{5796}$.

VIII. T

III. *To reduce a Fraction of one Denomination to another.*

1. This is either Aſcending, or Deſcending. Aſ-nding when a Fraction of a ſmaller is brought to a eater Denomination, and Deſcending when a Fraction a greater Denomination is brought lower.

2. When a Fraction is to be brought from a leſſer to greater Denomination, then make of it a Compound action by comparing it with the intermediate De-minations between it, and that you would have it duced to, then (by the *5th* Rule foregoing) reduce ur Compound to a ſimple Fraction, and the Work done. Example.

Queſt. 1. It is required to know what part of a und *ſterling* $\frac{5}{7}$ of a peny is?

To reſolve this, I conſider that 1 *d.* is $\frac{1}{12}$ of a ſhil-g, and a ſhilling is $\frac{1}{20}$ of a pound; wherefore $\frac{5}{7}$ *d.* is of $\frac{1}{12}$ of $\frac{1}{20}$ of a pound, which by the ſaid *6th* Rule ind to be $\frac{5}{1680}$ of a *l.* *ſterling* of *Engliſh* Money.

Queſt. 2. What part of a pound *Troy* weight is $\frac{4}{5}$ of penny weight? *Anſwer*, $\frac{4}{5}$ of $\frac{1}{20}$ of $\frac{1}{12}$ *l.* equal to $\frac{4}{00}$ *l. Troy.*

3. When a Fraction is to be brought from a greater a leſſer denomination, then multiply the Numerator the parts contained in the ſeveral denominations twixt it; and that you would reduce it to; then ce the laſt product over the denominator of the en Fraction. Example,

Queſt. 3. I would reduce $\frac{3}{5}$ *l.* to the Fraction of a ny; to do which I multiply the Numerator 3 by and 12, the product is 720, which I put over the nominator 5, it makes $\frac{720}{5}$ of a peny, equal to $\frac{3}{5}$ *l.*

Queſt. 4. What parts of an Ounce *Troy* is $\frac{5}{16}$ *l.*? *ſwer*, $\frac{60}{16}$ *oz.*

CHAP.

CHAP. XX.

Addition of Vulgar Fractions.

1. IF your Fractions to be added have a comm Denominator, then add all the Numerators t gether, and place their ſum for a Numerator to th common Denominator, which new Fraction is th Sum of all the given Fractions; and if it be impr per, reduce it to a whole or mixt Number, by th 3*d* Rule of the 19*th* Chapter.

Queſt. 1. What is the Sum of $\frac{7}{24}$, $\frac{9}{24}$, $\frac{16}{24}$, and $\frac{14}{24}$

The Denominators are equal, *viz*. every one is 2 wherefore add the Numerators together, *viz*. 7, 16 and 14, their Sum is 46, which put over the D nominator 24, it makes $\frac{46}{24}$ the Sum of the given Fr ctions, which will be reduced to the mixt Numb $1\frac{22}{24}$, or $1\frac{11}{12}$.

2. But if the Fractions to be added have unequ Denominators, then reduce them to a common D nominator by the 7*th* Rule of the 19*th* Chap. an then add the Numerators together, and put the Su over the common Denominator, &c. as before in th laſt Example.

Queſt. 2. What is the Sum of $\frac{3}{5}$, $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{11}{12}$?

The Fractions reduced to a common Denominat are $\frac{2880}{4800}$, $\frac{4200}{4800}$, $\frac{4320}{4800}$, and $\frac{4400}{4800}$, the Sum of the Numerators is 15800, which put over the comm Denominator, makes $\frac{15800}{4800}$ or $\frac{158}{48}$ equal to the mi number $3\frac{14}{48}$, or $3\frac{7}{24}$ for the Sum required.

Queſt. 3. What is the Sum of $\frac{13}{17}$, $\frac{21}{49}$, and $\frac{36}{47}$? A *ſwer*, $1\frac{37555}{39151}$.

3. If you are to add mixt numbers together, th add the fractional parts as before, and if their Sum an improper Fraction reduce it to a mixt numb and add its Integral part to the Integral parts of t given mixt Numbers, and the Work is done.

Queſt. 4. What is the ſum of $13\frac{3}{4}$ and $24\frac{5}{8}$?

Fi

Firſt add the fractions $\frac{3}{4}$ and $\frac{5}{8}$, the ſum is $1\frac{12}{32}$, then dd this Integer 1, to 13 and 24, their ſum is 38, nd put after it the fraction $\frac{12}{32}$ it is $38\frac{12}{32}$ for the *Anſw.* r it is $38\frac{3}{8}$.

Queſt. 5. What is the Sum of $48\frac{3}{7}$, $64\frac{5}{8}$ and $130\frac{3}{4}$ *ucit* $243\frac{180}{224}$, or $243\frac{45}{56}$.

4. If any of the Fractions to be added is a Compound Fraction, it muſt firſt be reduced to a ſimple raction by the *6th* Rule of Chapter 19, and then add to the reſt according to the 2*d* Rule of this Chapter. xample,

Queſt. 6. What is the Sum of $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$ of $\frac{3}{4}$ of $\frac{5}{6}$? Reduce $\frac{7}{8}$ of $\frac{3}{4}$ of $\frac{5}{6}$ into a ſimple fraction, and it is $\frac{5}{2}$, which reduced with the other two, and added e $1\frac{4686}{5760}$.

Queſt. 7. What is the Sum of $\frac{11}{12}$ and $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$? *ſwer,* $1\frac{5}{12}$.

5. If the fractions to be added are not of one demination, they muſt be ſo reduced, and then proed as before.

Queſt. 8. What is the Sum of $\frac{3}{4}$ *l.* and $\frac{5}{6}$ *s*?

Of the given fractions here, one is of a pound and e other the fraction of a ſhilling: and before you n add them together, you muſt reduce $\frac{5}{6}$ *s.* to the ction of a pound as the other is (by the *8th* le of Chapter 19) and it makes $\frac{5}{120}$ *l.* then $\frac{3}{4}$ *l.* and *l.* will be found to be $\frac{380}{480}$ *l.* or $\frac{38}{48}$ *l.* by the *7th* le of Chapter 19, and in its loweſt terms $\frac{19}{24}$ *l.* by *4th* Rule of Chapter 19.

It would have been the ſame, if (by the latter part the *8th* Rule of Chapter 19) you had reduced $\frac{3}{4}$ *l.* the *fraction* of a ſhilling, which you would have nd to have been $\frac{60}{4}$ *s.* which added to $\frac{5}{6}$ *s.* by the 17*th* Rule of the laſt Chap. the Sum is $15\frac{20}{24}$ *s.* ich is equal to the Sum found as before, *viz.* $\frac{19}{24}$ *l.* (by the *5th* Rule of Chapter 19) the value of $\frac{19}{24}$ *l.* be found to be 15 *s.* 10 *d.* and ſo will 15 *s.* $\frac{20}{24}$ be nd to be juſt as much.

Queſt. 9. What is the Sum of $\frac{2}{5}$ *l.* $\frac{3}{5}$ *s.* and $\frac{3}{5}$ *d.* *An*
ſwer $\frac{379500}{600000}$ or $\frac{3795}{6000}$ or *l.* in its loweſt terms $\frac{253}{400}$ *l.*

CHAP. XXI.

Subſtraction of Vulgar Fractions.

1 THE Rules in Addition for reducing the give Fractions to one *denomination*, are here to b obſerved; for before *Subſtraction* can be made, the *fra ctions* muſt be reduced to a common *denominator*, the *ſubſtract* one *Numerator* from the other, and place th *remainder* over the common *denominator*, which *fracti* ſhall be the exceſs or difference between the give *fractions*. Example,

Queſt. 1. What is the difference between $\frac{3}{4}$ and The given *fractions* are reduced to $\frac{21}{28}$ and $\frac{20}{28}$, then *ſub ſtract* the *numerator* 20 from the *numerator* 21, and the remains 1, which being put over the *denominator* 2 makes $\frac{1}{28}$ for the anſwer or difference between $\frac{3}{4}$ and

Queſt. 2. What is the difference between $\frac{5}{6}$ and of $\frac{5}{8}$?

Reduce the compound *fraction* $\frac{3}{5}$ of $\frac{5}{8}$ to a ſimp *fraction*, then proceed as before, and the anſwer $\frac{110}{240}$ equal to $\frac{11}{24}$.

2. When a *fraction* is given to be *ſubſtracted* from whole *number*, *ſubſtract* the *numerator* from the *denomin tor*, and put the *remainder* for a *numerator* to the given *de nominator*, and *ſubſtract* an Unit (for that you borrowe from the whole number, and the remainder place b fore the *fraction* found as before, which mixt numb is the remainder or difference ſought. Example,

Queſt. 3. *Subtract* $\frac{7}{10}$ from 48.

Anſw. 47 $\frac{3}{10}$; for if you *ſubtract* 7 (the *numerat* from 10 (the *denominator*) there remains 3, which p over 10 is $\frac{3}{10}$ and 1 (I borrowed) from 48 reſts 4 to which join $\frac{3}{10}$ and it makes 47 $\frac{3}{20}$ for the exceſs.

Queſt. 4. *Subtract* $\frac{13}{21}$ from 57, *remains* 56 $\frac{8}{21}$.

3.

3. If it is required to *ſubſtract* a *fraction* from a ixt number, or one mixt number from another, educe the *fractions* to a common *denominator*, and if e *fraction* to be *ſubſtracted* be leſſer than the other, en *ſubſtract* the leſſer numerator from the greater,and at is a numerator for the common denominator ; en *ſubſtract* the leſſer integral part from the greater, nd the *remainder* with the remaining *fraction* thereto nnexed, is the Difference required between the two iven mixt numbers. Example,

Queſt. 5. *Subſtract* 26 $\frac{3}{7}$ from 54 $\frac{5}{6}$.

Firſt, *Subſtract* $\frac{3}{7}$, *viz.* $\frac{18}{42}$ from $\frac{5}{6}$, *viz.* $\frac{35}{42}$, the emainder is $\frac{17}{42}$, then 26 from 54 remaineth 28, to hich annex $\frac{17}{42}$, it makes 28$\frac{17}{42}$ for the *Anſwer.*

4. But if the *fraction* to be ſubſtracted is greater than e Fraction from whence you ſubſtract, then having rſt reduced the Fraction to a common denominator, ke the numerator of the greater Fraction out of the enominator, and add the remainder to the numerator f the leſſer Fraction, and their Sum is a new nume-tor to the common denominator, which fraction ote, then (for the 1 you borrowed) add 1 to the In-gral part to be ſubſtracted, and ſubſtract it from the eater number, and to the remainder annex the fraion you noted before, ſo this new mixt number all be the difference ſought. Example,

Queſt. 6. Subſtract 14$\frac{3}{4}$ from 29$\frac{4}{7}$.

The fractions reduced are, *viz.* $\frac{3}{4}$ equal to $\frac{21}{28}$, and equal to $\frac{16}{28}$, now I ſhould ſubſtract $\frac{21}{28}$ from $\frac{16}{28}$,but I nnot, therefore I ſubſtract 21 from 28 reſts 7, which lded to 16 (the leſſer numerator) makes 23 for a merator to 28 ; *viz.* $\frac{23}{28}$, then I come to the Integral rts 14 and 29, and ſay 1 that I borrowed and 14 15, which taken from 29 there reſts 14, to which nexing $\frac{23}{28}$ it is 14$\frac{23}{28}$ for the remainder or diffe-nce between 14$\frac{3}{4}$ and 29$\frac{4}{7}$.

Queſt. 7. *Subſtract* 36$\frac{9}{10}$ from 74$\frac{4}{5}$ *facit* 37$\frac{4}{5}$.

CHAP. XXII

Multiplication of Vulgar Fractions.

1. IF the Multiplicand and Multiplier are ſimple (o ſingle) Fractions, then multiply the numerator together for a new numerator, and the denominator for a new denominator, which new Fraction is th product required.

Queſt. 1. What is the product of $\frac{5}{7}$ by $\frac{9}{11}$? *facit* $\frac{4}{7}$

For the numerators 5 and 9 being multiplyed mak 45, and the denominators 7 and 11 being multiplye make 77.

Queſt. 2. What is the product of $\frac{18}{23}$ by $\frac{21}{37}$? *fa.* $\frac{37}{85}$

2. If the Fractions to be multiplyed are mixt num bers reduce them to improper Fractions by the 1 Rule of the 19*th* Chapter, then proceed as before.

Queſt. 3. What is the product of $48\frac{3}{5}$ by $13\frac{5}{6}$?

The given mixt numbers being reduced to imprope fractions are $48\frac{3}{5}$ equal to $\frac{243}{5}$, and $13\frac{5}{6}$ equal to $\frac{83}{6}$ now $\frac{243}{5}$ multiplyed by $\frac{83}{6}$ according to the firſt Rul of this Chapter, produceth $\frac{20169}{30}$ or $672\frac{9}{30}$.

Queſt. 4. What is the product of $430\frac{6}{10}$ by $18\frac{3}{7}$ *facit* $\frac{555474}{70}$ or $7935\frac{24}{70}$.

3. If a compound Fraction is to be multiplied by ſimple Fraction, firſt reduce the compound fractio into a ſimple fraction, then multiply the one by th other, as is taught above.

Queſt. 5. What is the product of $\frac{16}{21}$ by $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$ the Compound Fraction $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$ reduced is $\frac{60}{140}$ o $\frac{6}{14}$ which multiplyed by $\frac{16}{21}$ produceth $\frac{96}{294}$ which i its loweſt terms is $\frac{16}{49}$ for the Anſwer.

And if the Multiplicand and Multiplyer are bot compound fractions, reduce them both to ſimple one then multiply theſe new fractions as before, ſo hav you the product.

Queſt. 6. What is the product of $\frac{3}{4}$ of $\frac{2}{3}$ by $\frac{3}{5}$ of $\frac{1}{2}$

Anſwer, $\frac{18}{120}$ in its loweſt terms $\frac{3}{20}$.

Queſt. 7. What is the product of $\frac{2}{3}$ of $\frac{3}{4}$ by $\frac{2}{5}$ of $\frac{5}{8}$?

Anſw. $\frac{60}{360}$ or $\frac{6}{36}$ or in its leaſt terms $\frac{1}{6}$.

4. If a Fraction be to be multiplyed by a whole number, put under the given whole number an Unit for a Denominator, whereby it will be an improper Fraction, then multiply theſe Fractions as before. Example.

Queſt. 8. What is the Product of 24 by $\frac{2}{3}$?

Anſw. $\frac{48}{3}$, for 24 by putting an Unit under it will be $\frac{24}{1}$, and $\frac{24}{1}$ by $\frac{2}{3}$ produceth $\frac{48}{3}$ or 16.

Queſt. 9. What is the Product of 35 by $\frac{9}{11}$? *Anſwer,* $\frac{24}{11}$ or $29\frac{5}{11}$

CHAP. XXIII.

Diviſion of Vulgar Fractions.

IF the dividend and the Diviſor are both ſimple Fractions, then multiply the numerator of the dividend into the denominator of the diviſor, and the product is a new numerator, and multiply the denominator of the Dividend into the Numerator of the Diviſor, and the product is a new Denominator, which new Fraction thus found, is the Quotient you deſire. Example.

Queſt. 1. What is the Quotient of $\frac{5}{8}$ divided by $\frac{3}{5}$?

Anſw. $\frac{25}{24}$ or $1\frac{1}{24}$, for I I multiply (5) the Numerator of the Dividend into (5) the denominator of the Diviſor, and the product (25) is numerator for the Quotient, then I multiply (8) the denominator of the dividend into (3) the numerator of the Diviſor, and the product (24) I put in the quotient for a denominator, ſo I find $\frac{25}{24}$ is the quotient ſought.

$$\frac{3}{5}\Big)\,\frac{5}{8}\,\Big(\frac{25}{24}$$

Queſt. 2. What is the quotient of $\frac{10}{21}$ divided by $\frac{2}{3}$?

Anſw. $\frac{30}{42}$ equal to $\frac{5}{7}$ in its loweſt terms.

2. But if you would divide a ſimple Fraction by a compound, or a compound by a ſimple, firſt reduce

ſuch compound to a ſimple Fraction, then go on as before.

Queſt. 3. What is the quotient of $\frac{3}{10}$ divided by $\frac{3}{4}$ of $\frac{2}{8}$? *Anſwer* $\frac{36}{60}$ or $\frac{3}{6}$, firſt reduce $\frac{3}{4}$ of $\frac{2}{8}$ into a ſimple Fraction, and it is $\frac{6}{12}$, by which $\frac{3}{10}$ being divided the Quotient is $\frac{36}{60}$ equal in its leaſt terms to $\frac{3}{6}$. And if the Dividend and Diviſor be both compound Fractions, reduce them both to ſimple Fractions, then divide the one by the other as in Rule 1 beforegoing.

Queſt. 4. What is the quote of $\frac{2}{3}$ of $\frac{3}{4}$ divided by $\frac{1}{}$ of $\frac{5}{6}$?

Anſw. $\frac{180}{120}$ or $\frac{18}{12}$ or $1\frac{6}{2}$ of $1\frac{1}{2}$ in its loweſt terms.

3. If the Dividend, or Diviſor, or both are mixt numbers, reduce them to improper Fractions, and perform Diviſion as you were taught before. Example.

Queſt. 5. What is the quote of $12\frac{3}{4}$ divided by $21\frac{4}{5}$?

Anſw. $\frac{255}{4369}$, for $12\frac{3}{4}$ is equal to $\frac{51}{4}$ and $21\frac{4}{5}$ is equal to $\frac{109}{5}$, and the quote of $\frac{51}{4}$ divided by $\frac{109}{5}$ is as before $\frac{255}{[illegible]}$.

4. If you divide a Fraction by a whole number, or a whole number by a Fraction, make the whole number an improper Fraction by putting an Unit for a denominator to it as was taught in Rule 4 of Chap. 2 and then perform Diviſion as before was taught. Example.

Queſt. 6 What is the Quote of 8 divided by $\frac{3}{5}$

Anſw. $\frac{40}{3}$ which is equal to $13\frac{1}{3}$ being reduced as is before directed. See the Work in the Margent.

$$\frac{3}{5}\Big)\frac{8}{1}\Big(\frac{40}{3} \text{ or } 13\frac{1}{3}$$

Queſt. 7 What is the Quotient of $\frac{3}{5}$ divided by 8? *Anſwer* $\frac{3}{40}$, as *per Margent.*

$$\frac{8}{1}\Big)\frac{3}{5}\Big(\frac{3}{40}$$

$$\frac{8}{1}\Big)\frac{3}{5}\Big(\frac{3}{40}$$

CHAP.

CHAP. XXIV

he Rule of Three Direct in Vulgar Fractions.

AS in the *Rule of* 3 in whole *Numbers*, ſo likewiſe in *Fractions*, you muſt ſee that the *Fractions* f the firſt and third places be of the ſame denomiation.

2. See that if any of the given *Fractions* be comound, that they be reduced to ſimple of the ſame alue.

3. If there are given mixt numbers, reduce them o improper *Fractions* by the firſt Rule of Chap. 19.

4. If any of the three terms is a whole number, ake it an improper *Fraction* by conſtituting a Unit or its *denominator*.

Having reduced your *Fraction* as is directed in the laſt *Rules*, then proceed to a Reſolution which is erformed the ſame way as in whole numbers, reect being had to the Rules delivered for the working f *Fractions, viz.* multiply the 2*d* and 3*d Fraction* ogether, according to the 1 Rule of Chap. 22. and diide the product by the firſt *Fraction*, according to the Rule of Chap. 23. and the Quotient is the Anſwer.

Or (which is better)

5. Multiply the numerator of the firſt Fraction ino the denominators of the ſecond and third, and the roduct is a new denominator, then multiply the deominator of the firſt Fraction into the numerators of he ſecond and third, and the product is a new numeator; which new Fraction is the 4*th* Proportional r anſwer, which (if it is an improper Fraction) muſt e reduced to a whole or mixt number by the third ule of Chap. 19. Examples,

Queſt. 1. If $\frac{3}{4}$ yards of Cloth coſt $\frac{5}{8}$ *l.* what will $\frac{1}{5}$ *yds* coſt?

Having placed the given Fractions according to the Rule of Chap. 10. I proceed to the reſolution, and ſt I multiply the numerator of the firſt Fraction (3) into 8 and 10, the denominators of the ſecond and third fractions, and the product is 240 for a denominator, then I multiply 4 the denominator of the firſt fraction into 5 and 9 the Numerators of the ſecond and third fractions the product is 180 for a Numerator, which Numerator 180 and denominator 240 make $\frac{180}{240}$ *l.* for the Anſwer, equal to $\frac{3}{4}$ *l.* or 15 *s.*

$$\begin{array}{cccc} \textit{yds} & l. & \textit{yds.} & l. \\ \frac{3}{4} & \frac{5}{8} & \frac{9}{10} & \frac{180}{240} \\ & l. & & l. \\ \multicolumn{4}{c}{\textit{facit}\ \frac{180}{240}\ \text{equal to}\ \frac{3}{4}} \end{array}$$

Queſt. 2. If $\frac{2}{3}$ *l.* buy $\frac{5}{6}$ *yds* of Cloth, what will $\frac{11}{12}$ *yds* coſt at that rate?

Anſwer, $\frac{132}{180}$ *l.* equal to $\frac{11}{15}$ *l. or* 14 *s.* 8 *d.*

Queſt. 3. If $\frac{7}{8}$ *l.* coſt $\frac{3}{4}$ *s.* what will $\frac{8}{9}$ *s.* buy?

Anſwer, $\frac{224}{216}$ *l.* equal to $1\frac{1}{27}$ *l.*

Queſt. 4. If $\frac{3}{5}$ of an Ell of Holland coſt $\frac{1}{3}$ of a pound, how much will $12\frac{2}{3}$ ells coſt at that rate?

Anſwer, $\frac{190}{27}$ equal to $7\frac{1}{27}$ *l.*

In reſolving the laſt queſtion, and the two next, obſerve the Third Rule of this Chapter foregoing.

Queſt. 5. If $\frac{9}{10}$ of a *C.* coſt 284 *s.* what will $7\frac{1}{2}$ *C.* coſt at that rate?

Anſwer, 239 $\frac{7}{2}$ *s.* or 11 *l.* 19 *s.* 7 *d.*

Queſt. 6. If $3\frac{1}{4}$ yards of Velvet coſt $3\frac{5}{8}$ *l.* how much will $10\frac{1}{2}$ yards coſt at that rate?

Anſwer, $11\frac{37}{52}$ *l.*

Queſt. 7. If 3 *yds* of Broad Cloth coſt $2\frac{4}{5}$ *l.* what will $14\frac{3}{7}$ yds coſt?

Anſwer, 13 *l.* 9 *s.* 4 *d.*

In working the laſt queſtion and the 4 next, obſerve the *4th.* Rule of this Chap. foregoing.

Queſt. 8. If 14 *l.* of Pepper coſt 14 *s.* $6\frac{3}{5}$ *d.* I demand the price of $73\frac{3}{4}$ *l.*

Anſwer, 3 *l.* 16 *s.* $7\frac{43}{56}$ *d.*

Queſt. 9. If 1 *l.* of Cochenele coſt 1 *l.* 5 *s.* what will $36\frac{7}{10}$ *l.* coſt?

Anſwer, 45 *l.* 17 *s.* 6 *d.*

Queſt. 10. If one yard of broad-cloth coſt 15$\frac{5}{8}$ *s.* hat will 4 pieces, each containing 27$\frac{3}{7}$ yards at that ate ?

Anſwer, 85 *l.* 14 *s.* 3$\frac{3}{7}$ *d.*

Queſt. 11. A Mercer bought 3$\frac{1}{3}$ pcs of ſilk, each pc r. 24$\frac{2}{3}$ ells at 6 *s.* 0$\frac{3}{4}$ *d.* *per* Ell, I demand the value of pcs at that rate ?

Anſwer, 25 *l.* 3 *s.* 4$\frac{3}{4}$ *d.*

In ſolving the 4 next queſtions obſerve the 8. Rule f Chap. 19.

Queſt. 12. If $\frac{2}{5}$ of an ounce of Silver coſt 2 *s.* I mand the price of 11$\frac{2}{3}$ *l.* at that rate ?

Anſwer, 35 *l.*

Queſt. 13. If 5$\frac{1}{}$$\frac{5}{7}$ *l.* of Gold is worth 61$\frac{5}{7}$ *l.* *ſterling*, hat is 1 grain worth at that rate ?

Anſwer, 1$\frac{1}{2}$ *d.*

Queſt. 14. If $\frac{3}{4}$ yds of Silk is worth $\frac{3}{4}$ of $\frac{5}{6}$ *l.* what the price of 15$\frac{2}{5}$ Ells *Flemiſh* ?

Anſwer, 9 *l.* 12 *s.* 6 *d.*

Queſt. 15. If $\frac{2}{3}$ of $\frac{3}{4}$ of a pound of Cloves coſt 6 *s.* *d.* what coſt the *C.* weight at that rate ?

Anſwer, 69 *l.* 6 *s.* 8 *d.*

Note that when the Anſwers to the Queſtions in this d the next Chap. are given in Fractions, they are ven in their loweſt Terms.

CHAP. XXV.

The Rule of Three Inverſe in Fractions.

IT hath been already taught (in the third Rule of the 11*th* Chap.) how to diſcover when the 4*th* oportional number (to the 3 given numbers) is be found out by a Rule of 3 Direct, and when by Rule of Three Inverſe, to which Rule the Learner is w referred.

2 When (in Fractions) you find a queſtion to be lved by the Rule of 3 Inverſe, *viz.* when the third rm is the Diviſor, then (having reduced the terms

exactly according to the Rules in Chap. 24) multipl the numerators of the 3 Fractions into the denomina tors of the ſecond and firſt Fractions, and the produc is a new Denominator, then multiply the denomina tor of the third Fraction into the numerators of ſecon and firſt Fractions, and the product is a new numera tor, which new fraction thus found is the anſwer t the queſtion.

Queſt. 1. If $\frac{3}{4}$ of a yard of Cloth that is 2 *yds* wide will make a Garment, how much of any other Dra pery, that is $\frac{3}{5}$ of a yard wide will make the ſame Garment ?

Anſwer, 2$\frac{1}{2}$ *yds.*

Queſt. 2. Lent my Friend 46 *l.* for $\frac{4}{5}$ of a year, how much ought he to lend me for $\frac{7}{12}$ of a year ?

Anſwer, 63$\frac{3}{35}$ *l.*

Queſt. 3. If $\frac{2}{3}$ of a yard of Cloth that is 2$\frac{1}{3}$ *yds* wide will make any Garment, what breadth is that Cloth, when 1 $\frac{3}{4}$ *yds* will make the ſame Garment ?

Anſwer, $\frac{59}{63}$ of a *yd* wide.

Queſt. 4. How many inches in length of a board that is 9 Inches broad will make a Foot ſquare ?

Anſwer, 16 inches in length.

Queſt. 5. If when the buſhel of Wheat coſt 4$\frac{3}{4}$ *s.* the penny Loaf weigheth 10 $\frac{2}{3}$ Ounces, what will it weigh when the buſhel coſt 8$\frac{9}{10}$ *s.* ?

Anſwer, 5$\frac{185}{267}$ Ounces.

Queſt. 6. If 12 Men can mow 24$\frac{1}{2}$ Acres in 10$\frac{2}{3}$ days, in how many days will 6 Men do the ſame ?

Anſwer, In 21$\frac{1}{3}$ days.

CHAP. XXVI.

Rules of Practice.

1. IN the ſingle Rule of 3, when the firſt of the 3 Numbers in the Queſtion (after they are diſpoſed according to the 6*th*. Rule of Chap. 10) hapneth

to be an Unit (or 1) that Queſtion many times may be reſolved far more ſpeedily than by the Rule of 3, which kind of Operation is commonly called Practice, and indeed it is of excellent uſe amongſt Merchants, Tradeſmen and others, by reaſon of its ſpeedineſs in finding a reſolution to ſuch kind of Queſtions.

2. The chiefeſt Queſtion reſolvable by theſe brief Rules may be comprehended under the ſeveral general heads or caſes following, *viz.*

When the given Price of the Integer conſiſts,
1 *Of farthings under* 4
2 *Of pence under* 12
3 *Of pence and farthings*
4 *Of ſhillings under* 20
5 *Of ſhillings, pence and farthings*
6 *Of Pounds*
7 *Of pounds, ſhillings, pence and farthings.*

It would be very convenient for the Practical Arithmetician to have by heart the ſeveral products of the Nine Digits multiplyed by 12, for his ſpeedy reducing pence into ſhillings, or ſhillings into pence, which he may gain by the following Table.

12 Times		
	1	12
	2	24
	3	36
	4	48
	5	60
	6	72
	7	84
	8	96
	9	108

3. Shillings are practically reduced into pounds thus, *viz.* cut off the figure ſtanding in the place of Units with a daſh of the pen and note it for ſhillings, then draw a line under the given Number, and take

half of the remaining figures (after the firſt is cut off) and ſet them under the line, and they are ſo many pounds, but if the laſt figure is odd, then take the leſſer half, and add 10 to the figure ſo cut off (as before) for ſhillings, as if I were to reduce 43658 ſhillings into pounds, firſt I cut off the laſt figure (8) for ſhillings, then I take half of the remaining figures (4365) thus half of 4 is 2, which I put under the line, then $\frac{1}{2}$ of 3 is 1, and becauſe 3 is an odd number, I make the next figure 6 to be 16, and I go on, ſaying, $\frac{1}{2}$ of 15 is 8, and then $\frac{1}{2}$ of 5 is 2, which is the laſt figure, wherefore becauſe 5 is an odd number, I add 10 to the 8 I cut off, and it makes 18 *s.* ſo that I find it to be 2182 *l.* 13 *s.* as *per Margent.*

4365	8
l.	s.
2182	18

4. It is likewiſe convenient that the Learner be acquainted with the practical Tables following, the firſt containing the Aliquot (or even) parts of a ſhilling, the ſecond containing the Aliquot parts of a pound.

	d.		*s.*
The even Parts of a ſhilling.	6	is	$\frac{1}{2}$
	4		$\frac{1}{3}$
	3		$\frac{1}{4}$
	2		$\frac{1}{6}$
	$1\frac{1}{2}$		$\frac{1}{8}$
	1		$\frac{1}{12}$

	s. *d.*		*l.*
The even parts of a pound	10—00	is	$\frac{1}{2}$
	6—08		$\frac{1}{3}$
	5—00		$\frac{1}{4}$
	4—00		$\frac{1}{5}$
	3—04		$\frac{1}{6}$
	2—06		$\frac{1}{8}$
	2—00		$\frac{1}{10}$
	1—08		$\frac{1}{12}$
	1—00		$\frac{1}{20}$

Caſe 1.

5. When the price of the Integer is a Farthing, then take the ſixth Part of the given Number, which will be ſo many three half-pences, and if any thing Remains it is Farthings, by the *7th* Rule of Chap. 9. then conſider that three half-pence is $\frac{1}{8}$ of a ſhilling, wherefore take the eighth part of them for ſhillings, and if any thing remain they are ſo many 3 half-pence, which reduce into pounds by the Third Rule foregoing. Example, What comes 67486 *l.* to at a Farthing *per l.* Firſt, I take $\frac{1}{6}$ of 67485 and it is 11247 three half-pence and 4 farthings, or one peny; then $\frac{1}{8}$ of 11247 is 1405 *s.* and 7 remains, which is 7 three half-pence, or 10$\frac{1}{2}$ *d.* which with the 4 farthings before make 11$\frac{1}{2}$ *d.* and 1405 ſhillings, which by the 3 Rule is 70 *l.* 5 *s.* In all 70 *l.* 5 *s.* 11$\frac{1}{2}$ *d.* for the *Anſwer.* See the Work following.

d.
$\frac{1}{6}$ | 67486 *at* $\frac{1}{4}$ *per l.*
d.
$\frac{1}{8}$ | 11247--1
$\frac{1}{20}$ | 1405—10$\frac{1}{2}$
l. *s.* *d.*
70—5—11$\frac{1}{2}$ *facit*

Other Examples follow.

$\frac{1}{6}$ | 8576 *l. at* 1 *qr.*
$\frac{1}{8}$ | 1429 — 2 *qrs.*
$\frac{1}{20}$ | 178 — 8 *d.*
l. s. d.
8—18—8 *facit*

$\frac{1}{6}$ | 6380 *l. at* 1 *qr.*
$\frac{1}{8}$ | 1063 — 2 *qrs.*
$\frac{1}{20}$ | 132 — 11 *d.*
l. s. d.
6—12—11 *facit*

6. When the price of the Integer is 2 farthings, then take the third part of the given Number for ſo many three-half-pences, and the Remainder (if any) is half pence, then take the eighth part of that for ſhillings, as before, *&c.*

Examples.

$\frac{1}{3}$	7368 *l.* at 2 *qrs.*
$\frac{1}{8}$	2456
$\frac{1}{20}$	30|7
	l. s.
	15 7 *facit*

$\frac{1}{3}$	8347 *l.* at 2 *qrs.*
$\frac{1}{8}$	2782 —— 2 *qrs.*
$\frac{1}{20}$	341|7 —— 9 *d.* $\frac{1}{2}$
	l. s. d.
	17—7—9 *facit*

7. When the price of the Integer is 3 farthings, then take half the given Number for three half-pence, (and if any thing remain it is 3 farthings) then take the eighth of that for ſhillings as before, *&c.*

Examples.

$\frac{1}{2}$	4736 *l.* at 3 *qrs.*
$\frac{1}{8}$	2368
$\frac{1}{20}$	29|6
	l. s.
	14—16 *facit*

$\frac{1}{2}$	5425 *l.* at 3 *qrs.*
$\frac{1}{8}$	2712 —— -3 *qrs.*
$\frac{1}{20}$	33|6
	l. s. d. qrs.
	16---19-0--3 *fa.*

Caſe 2.

8. When the given price of the Integer, is a part, or parts of a ſhilling (*viz.* pence) divide the given Number of Integers (whoſe value is ſought) by the Denominator, of the fraction repreſenting the even part, and the quote is ſhillings, (always minding the 7*th.* Rule of the 9*th.* Chap.) and thoſe ſhillings may be reduced into *l.* by the 3*d.* Rule of this Chapter. Examp. Let it be required to find the value of 438 *l.*

438 *l.* at 3 *d. per l.* I conſider 3 *d.* is $\frac{1}{4}$ of a ſhilling, and 438 *l.* will coſt ſo many 3 pences, wherefore I divide 438 by 4 the denominator of $\frac{1}{4}$, and the quote is 109 ſhillings, and 2 remains, which is 2 three pences or 6 *d.* the whole value is 5 *l.* 9 *s.* 6 *d.* as by the following work appeareth.

$\frac{1}{4}$ | 438 *l. at* 3 *d.*
$\frac{1}{20}$ | 10|9 —— 6
l. s. d.
facit 5—9—6

More Examples follow.

l. d.
$\frac{1}{2}$ | 3574 *at* 6 *per l.*
$\frac{1}{20}$ | 178|7
facit 89 *l.* 7 *s.*

l. d.
5316 *at* 2 *per l.*
$\frac{1}{20}$ | 88|6
facit 44 *l.* 6 *s.*

l. d.
$\frac{1}{3}$ | 438 *at* 4 *per l.*
$\frac{1}{20}$ | 14|6
facit 7 *l.* 6 *s.*

l. d.
$\frac{1}{8}$ | 6389 *at* 1 $\frac{1}{2}$ *per l.*
$\frac{1}{20}$ | 79|8 —— 7 *d.* $\frac{1}{2}$
facit 39 *l.* 18 *s.* 7 *d.* $\frac{1}{2}$

l. d.
$\frac{1}{4}$ | 879 *at* 3 *per l.*
$\frac{1}{20}$ | 21|9 — 9 *d.*
facit 10 *l.* 19 *s.* 9 *d.*

l. d.
$\frac{1}{12}$ | 88 *at* 1 *per l.*
$\frac{1}{20}$ | 6|8 —— 2 *d.*
facit 3 *l.* 8 *s.* 2 *d.*

9 If the price of the Integer be pence under 12, and yet not an even part, then it may be divided into given parts, and ſo the parts of the given Number ta-

ken accordingly, and added together, as if it were 5 *d.* which is 3 *d.* and 2 *d.* *viz.* $\frac{1}{4}$ and $\frac{1}{6}$ of a ſhilling, firſt take $\frac{1}{4}$ of the given number, and then $\frac{1}{6}$ thereof and add them together, and their Sum is the Anſwer in ſhillings, ſtill obſerving Rule 7. of Chap. 9. for the remainders, (if any be) then bring the ſhillings into pounds by the 3 Rule foregoing. Likewiſe 7 *d.* is $\frac{1}{3}$ and $\frac{1}{4}$, ſo 9 *d.* is $\frac{1}{2}$ and $\frac{1}{4}$, and 10 *d.* is $\frac{1}{4}$ and $\frac{1}{4}$, and 11 *d.* is $\frac{1}{3}$ and $\frac{1}{3}$ and $\frac{1}{4}$ of a ſhilling or elſe many times your work may be ſhortned thus, *viz.* when the ſaid given price is to be divided into even parts of a ſhilling or of a pound, after you have taken the firſt even part, the other may be an even part of that part, as in the next Example, where is given 439 *l.* at 5 *d.* *per l.* now I may divide it thus, *viz.* into 4 *d.* and 1 *d.* and 4 *d.* being $\frac{1}{3}$ of a ſhilling, and 1 *d.* being $\frac{1}{4}$ of 4 *d.* I firſt take $\frac{1}{3}$ of 439 *l.* and it gives 146 *s.* 4 *d.* and for the 1 *d.* I take $\frac{1}{4}$ of 146 *s.* 4 *d.* which is 36 *s.* 7 *d.* which in all comes to 9 *l.* 2 *s.* 11 *d.* Examples follow.

	l. d.
	439 *at* 5 *per l.*
$\frac{1}{3}$	146——4
$\frac{1}{4}$	36——7
	18|2—11
	9 *l.* 2 *s.* 11 *d.* *facit*

	yds. d.
	417 *at* 9 *per yd*
$\frac{1}{2}$	208——6
$\frac{1}{2}$	104——3
	31|2——9
	15 *l.* 12 *s.* 9 *d.* *facit*

	ells d.
	587 *at* 7 *per Ell*
$\frac{1}{3}$	195——8
$\frac{1}{4}$	146 — 9
	34|2——5
	17 *l.* 2 *s.* 5 *d.* *facit*

	ells d.
	386 *at* 10
$\frac{1}{2}$	193
$\frac{1}{3}$	128——8
	32|1——8
	16 *l.* 1 *s.* 8 *d.* *facit*

yds. d.
336 *at* 8 *per yd*

$\frac{1}{3}$ | 278——8
$\frac{1}{3}$ | 278——8

5517——4

27*l.* 17*s.* 4*d.* *facit*

l. d.
534 *at* 11

$\frac{2}{3}$ | 178
$\frac{1}{3}$ | 178
$\frac{1}{4}$ | 133——6

4819——6

24*l.* 9*s.* 6*d.* *facit*

Caſe 3.

10. When the price of the Integer is pence and farthings, if it make an even part of a ſhilling, work as before, but if they are uneven, as penny farthing, penny three farthings, 2 *d.* 1 *qr.* or 2 *d.* 3 *qrs.* 3 *d.* 3 *qrs.* or the like, then firſt work for ſome even part, and then conſider what part the reſt is of that even part, and divide that quotient thereby, then add them together, and reduce them to pounds as before, Example, 3470 *l.* at 1 *d.* 1 *qr.* *per l.* firſt I work for the penny by dividing 3470 by 12, for 1 *d.* is $\frac{1}{12}$ of a ſhilling, and the quote is 289 *s.* 2 *d.* then I conceive that one farthing is the $\frac{1}{4}$ of a peny, and the value at one farthing, will be $\frac{1}{4}$ of the value at 1 peny, and therefore I take $\frac{1}{4}$ of 289 *s.* 2 *d.* which is 72 *s.* 3 *d.* 2 *qrs.* and add them together, and they are 18 *l.* 1 *s.* 5 *d.* 2 *qrs.* as by the Margent. Other Examples of the ſame nature follow.

l. *qrs.*
3470 *at* 5

289——2
72——3——2

3611——5——2

l. *s.* *d.* *qrs.*
18—1—5—2

4360

l. d.
$\frac{1}{12}$ 4360 *at* 1 $\frac{1}{4}$
$\frac{1}{4}$ 363—4
90—10
45|4—2
l. *s.* *d.*
22—14—2 *facit*

yds d.
$\frac{1}{8}$ 573 *at* 1 $\frac{3}{4}$
$\frac{1}{6}$ 71—7 $\frac{1}{2}$ *d.*
11—11 $\frac{1}{4}$
8|3—6 $\frac{3}{4}$
l. *s.* *d.*
facit 4—3—6 $\frac{3}{4}$

$\frac{1}{6}$ 485 *l. at* 2 $\frac{1}{4}$ *d.*
$\frac{1}{8}$ 80—10 *d.*
10—1 $\frac{1}{4}$
9|0—11 $\frac{3}{4}$
4 *l.* 10 *s.* 11 $\frac{1}{4}$*d.*

$\frac{1}{2}$ 520 *yds* at 7 $\frac{1}{2}$
$\frac{1}{4}$ 260
65
2|25
16 *l.* 5 *s.* *facit*

$\frac{1}{6}$ 654 *l.* at 2 $\frac{1}{2}$ *d.*
$\frac{1}{4}$ 109
27—3 *d.*
13|6—3
6 *l.* 16 *s.* 3 *d.*

137 *yds* at 10 $\frac{1}{2}$
$\frac{1}{2}$ 68—6 *d.*
$\frac{1}{2}$ 34—3
$\frac{1}{8}$ 17—1 $\frac{1}{2}$
11|9—10 $\frac{1}{2}$ *d.*
5 *l.* 19 *s.* 10$\frac{1}{2}$ *facit*:

Case 4.

11. When the price of the Integer is 2 *s.* then cut off the figure in the place of Units of the given number, and double it for ſhillings, and the figures on the other hand are pounds. Example 436 *yds* at 2 *s. per yd*, cut off the laſt figure 6 and double it, it makes 12 ſhill. and the other 2 figures, *viz.* 43 are ſo many pounds, ſo that their value is 43 *l.* 12 *s.* as *per Margent.*

43|6
43 *l.* 12 *s.*

12. Hence it is evident that when the given price f an Integer is an even number of ſhillings, then if ou take half of that even number of ſhillings, and ultiply the given number of Integers thereby, dou-ing the firſt figure of the product, and ſetting it part for ſhill. the reſt of the product will be pounds, hich pounds and ſhill. is the value ſought. Example, Vhat coſt 526 *yds* at 8 *s.* *per yd*? To reſolve which, take $\frac{1}{2}$ of 8 s. (the price of a *yd*) which is 4, and ultiply 536 thereby, ſaying, 4 mes 6 is 24, then I double the rſt figure 4 makes 8 for ſhill. nd carry 2 to the next product, *rc.* I find the reſt of the pro-uct to be 214 which I note for pounds, ſo the value f 536 *yds* at 8 *s.* *per yd* is 214 *l.* 8 *s.* as *per* Margent. lore Examples follow.

546 *yds* at 8 *s.*

214 *l.* 8 *s.*

6 yds at 6 s. per yd

16 l. 16 s. *facit*

23 yds at 4 s. per yd

24 l. 12 s. *facit*

8 ells at 8 s. per ell

19 l. 4 s. *facit*

4 yds at 10 s. per yd

42 l. *facit*

420 yds at 12 s. per yd

252 l. *facit*

326 yds at 14 s. per yd

228 l. 4 s. *facit*

48 yds at 16 s. per yd

38 l. 8 s. *facit*

52 yds at 18 s. per yd

46 l. 16 s. *facit*

13. If the given price of the Integer is an odd umber of ſhillings, then work firſt for the even number f ſhillings by the laſt Rule, and for the odd ſhilling take $\frac{1}{[illegible]}$ of the given Number of Integers according to the Rule of this Chap. and add them together, and you ave your deſire. Examples follow.

yds *s.*
422 *at* 3 *per yard*

l. *s.*
42——4
21——2

63——6 *facit*

ells *s.*
431 *at* 13

l. *s.*
258——12
21——11

280——03 *facit*

ells *s.*
516 *at* 7 *per ell*

l. *s.*
154——16
25——16

180——12 *facit*

ells *s.*
324 *at* 17 *per ell*

l. *s.*
259——4
16——4

275——8 *facit*

14. Except when the given price of the Integer is 5 *s.* for then it is ſooner anſwered by taking $\frac{1}{4}$ of the given Number whoſe value is ſought, as in the following Example.

$\frac{1}{4}$	*yds* *s.* 436 *at* 5 *per yard*
	109 *l. facit*

$\frac{1}{4}$	*ells* *s.* 206 *at* 5 *per ell*
	51 *l.* 10 *s. facit*

Caſe 5.

15. When the given price of an Integer is ſhillings and pence, or ſhillings, pence and farthings; then if the ſhillings and pence be an even part of a pound, divide the given number of Integers, whoſe value you ſeek by the denominator of that Fraction repreſenting that even part. As for Example, what is the price of 384 *yds* at 6 *s.* 8 *d. per yd*? Here I conſider that 6 *s.* 8 *d.* is $\frac{1}{3}$ of a pound, wherefore

384 by 3 and the Anſwer, *viz* 128 *l.* 384 *yds* at 6 *s.* 8 *d.* *per yd* unts to 128 *l.* as *per margent*, ſtill rving the 7*th* Rule of the 9*th* apter.

$\frac{1}{3}$ | 384
128*l.* *facit*

More Examples follow.

438 *ells at* 6 *s.* 8 *d.*
146 *l.* *facit*

525 at 3 *s.* 4 *d.*
87 *l.* 10 *s.* *facit*

$\frac{1}{8}$ | 443 *yds at* 2 *s.* 6 *d.*
55 *l.* 7 *s.* 6 *d.* *facit*

$\frac{1}{12}$ | 725 *yds at* 1 *s.* 8 *d.*
60 *l.* 10 *s.* *facit*

16. When the given value of the Integer is ſhillings d pence, and not an even part of a pound, yet ma- times it may be divided into parts (*viz.* 6 *s.* 6 *d.* is . and 2 *s.* 6 *d.* for the 4 *s.* work according to the Rule foregoing, and for the 2 *s.* 6 *d.* take the ith part of the given Number and add them to- her, then their ſum is the value required.)

o 8 *s.* 6 *d.* will be divided into 6 *s.* and 2 *s.* 6 *d.* d the price of the given Number may be found t as before, *&c.* Examples follow.

yds *s.* *d.*
386 *at* 8—8
$\frac{1}{3}$ | 128*l.*—13—4
$\frac{1}{10}$ | 38—12—0
167*l.* 5*s.* 4*d.* *facit*

ells *s.* *d.*
s. | 540 *at* 5—4
2 | 54*l.*——0 *s.*
$\frac{1}{6}$ | 90——0
144 *l.* 0 *s.* *facit*

ells *s.* *d.*
s. | 427 *at* 8—6
6 | 128 *l*—2—0
$\frac{1}{8}$ | 53——7—6
181*l.* 9*s.* 6*d.* *facit*

yds *s.* *d.*
s | 386 *at* 14—8
8 | 154*l.* — 8—0
$\frac{1}{3}$ | 128——13—4
283*l.* 1*s.* 4*d.* *facit*

17. When the given price of the Integer is ſhilling and pence, and you cannot readily divide them according to the laſt Rule, then multiply the given numbe whoſe value you ſeek by the number of ſhillings in the price of the Integer, and then for the pence work by the 8*th* Rule foregoing, then add the Numbers together, and their Sum is the value ſought in ſhillings; as for Example, what is the value of 392 *yds* at 6 *s.* 9 *d.* *per yard.* Here 6 *s.* 9 *d.* cannot be made any even part, nor indeed can it be divided into even parts of a pound, wherefore I multiply the given number of *yards* 392 by 6, for the 6 *s.* the product is 2352 ſhillings, then for the 9 *d.* I divide it into 6 and 3 *d.* and work for them by the 8*th* Rule foregoing, and at laſt add the ſhillings together, they make 2646 *s.* and by the 3 Rule they are reduced to 132 *l.* 6 *s.* the value of 392 *yds* at 6 *s.* 9 *d.* *per yard* Seet he work following.

	yds	*s.*	*d.*
	392 *at*	6——	9
	2352		
½	196		
¼	98		
	264|6		
	1132 *l.* 6 *s. facit*		

Other Examples follow.

s.	*l.*	*s.*	*d.*
	480 *at*	4——	10
4	1920		
½	240		
⅓	160		
	232|0		
	116 *l. facit.*		

s.	*ells.*	*s.*	*d.*
	732 *at*	12——	7
12	8784		
⅓	244		
¼	183		
	921|1		
	460 *l.* 11 *s. facit.*		

§ 18. When the given price of the Integer is ſhil- gs, pence and farthings, then multiply the given mber of Integers by the number of ſhillings con- ned in the value of the Integer, and for the pence d farthings follow the 10th Rule of this Chapter.

Examples.

	yds. s. d.
s.	438 *at* 8——6 $\frac{3}{4}$.
8	3504
$\frac{1}{2}$	219
$\frac{1}{8}$	27—4 $\frac{1}{2}$ *d.*
	275|0—4 $\frac{1}{2}$
	fac. 187 *l.* 10 *s.* 4$\frac{1}{2}$*d.*

	ells s. d.
	370 *at* 14——2$\frac{3}{4}$
	1480
s.	370
14	5180 d.
$\frac{1}{6}$	61——8
$\frac{1}{4}$	15——5
$\frac{1}{2}$	7——8$\frac{1}{2}$
	526|14—— 9$\frac{1}{2}$
	fac. 263*l.* 4*s.* 9 *d* $\frac{1}{2}$.

	ells s. d.
.	136 *at* 9——2 $\frac{1}{2}$
9	1224——0
$\frac{1}{6}$	22——8
$\frac{1}{4}$	5——8
	125|2—— 4
	fac. 62 *l.* 12 *s.* 4 *d.*

	ells s. d.
s.	431 *at* 2——4 $\frac{1}{2}$
2	862
$\frac{1}{4}$	107——9 *d.*
$\frac{1}{8}$	53——10 $\frac{1}{2}$.
	102|3——7 $\frac{1}{2}$
	facit 51*l.* 3*s.* 7$\frac{1}{2}$*d.*

Caſe

Caſe 6.

19. When the given value of the Integer is pounds then multiply the Number of Integers whoſe value i ſought by the price of the Integer, and the product i the anſwer in pounds.

Examples.

C. *l.*
42 *at* 2 *per* C.
84 *l.* *facit*

C. *l.*
13 *at* 8 *per* C.
104 *l.* *facit*

C. *l.*
30 *at* 3 *per* C.
90 *l.* *facit*

C. *l.*
48 *at* 12 *per* C.
576 *l.* *facit*

Caſe 7.

20. If the price of the Integer is pounds and ſhillings, then for the pounds work as in the laſt Rule, and for the ſhillings as in the 12 and 13 Rules beforegoing : then add the Numbers produced from them both, and the Sum is the Value ſought.

Examples.

C. *l.* *s.*
46 *at* 2—4
2 *l.* 92 *s.*
4 *s.* 9—4
101 *l.* 4 *s.* *facit.*

groſs *l.* *s.*
82 *at* 4—10
4 *l.* 328
10 *s.* 41
369 *l.* *facit*

groſs *l.* *d.*
58 *at* 3—7
3 *l.* 174 *s.*
6 *s.* 17—8
1 *s.* 2—18
194 *l.* 6 *s.* *facit*

groſs *l.* *s.*
26 *at* 3—15
3 *l.* 78
14 *s.* 18—4
1 *s.* 1—6
97 *l.* 10 *s.* *facit*

21. When the given price of an Integer conſiſts of
unds, ſhillings, and pence, with farthings, then
rk for the ſhillings, pence, and farthings, firſt ac-
rding to the 18 Rule of this Chapter, and find the
alvalue of the given Number, as if there were no
unds, then work with the pounds according to the
Rule of this Chapter, and add the Numbers thus
and, and their Sum is the total value required.

Examples of this Rule follow.

C. *l.* *s.* *d.*
213 at 1—13—4½

639
213

3 *s.* 2769 *d.*
d. 53——3
½ *d.* 26——7½

284|8——10½

l. 142 *l.* 08 *s.* 10½ *d.*
213

355 *l.* 8*s.* 10½*d. facit*

C. *l.* *s.* *d.*
37 at 3—8—10½

296 *d.* | 8 *s.*
18—6 | 6 *d.*
9—3— | 3 *d.*
4—7½ | 1½ *d.*

32|8--4½ *d.*

16 *l.* 8 *s* 4½ *d*
111 | 3 *l.*

127 *l.* 8 *s.* 4½ *d. fac.*

groſs *l.* *s.* *d.*
416 at 3—9—3¾

s. 3744
d. 104
d. 26

38714

193 *l.* 14 *s.*
l. 832

1025 *l.* 14 *s. facit*

groſs *l.* *s.* *d.*
48 at 3—15—11½
240
48
720 | 15 *s.*
24 | 6 *d.*
16 | 4 *d.*
6 | 1½ *d.*
7616
38—6
144 | 3 *l.*
182 *l.* 6 *s. facit*

22. When there is given the value of an Integer and it is required to know the value of many ſuc Integers together, with ¼ or ½ or ¾ of an integer then firſt (by the former rules) find out the Valu of the given number of Integers, and then for ¼ t an integer take ¼ of the given value of the Integer or for ½ take ½ of the given value of the integer, and fc ¾ firſt take the ½ of the given value, and then ½ of tha ½, ſetting each part under the precedent, then addin them together, their Sum will be the required valu of the Integers and their parts. Example; what is th value of 116½ *yds.* at 4 *s.* 6 *d. per yard*? To give a Anſwer, firſt I work for the value of 116 *yds.* by the 15*th.* Rule foregoing, and then for the ½ *yd.* I take ½ of 4 *s.* 6 *d.* which is 2 *s.* 3 *d.* and add to the reſt found as before, then is that Sum the total value of 116½ *yds.* at 4 *s.* 6 *d. per yard*, which I find to amount to 26 *l.* 4 *s.* 3 *d.* as by the work in the Margent

yds.	*s.*	*d.*
116½ *at*	4——	6.

11 *l.* 12*s.*	2*s.*
14—10*d.*	2*s.* 6*d.*
2—3	½ *yd.*
26—4—3 *facit*	

Other Examples follow.

324¾ *yds. at* 4 *s.* 10 *d.*

1296 ——	4 *s.*
162 ——	6 *d.*
108 ——	4 *d.*
1—2½ *d.*	¼ *yd.*
15617 *s.* 2½ *d.*	
78 *l.* 7 *s* 2½ *d. facit*	

228¾ *ells at* 12 *s.* 11 *d.*

2736 ——	12 *s.*
76 ——	4 *d.*
76 ——	4 *d.*
57 ——	3 *d.*
6 —— 5½ *d.*	½ *ell.*
3 —— 2¾ *d.*	¼ *ell.*
2954——¼	
147 *l.* 14 *s.* 8¼ *d facit*	

720½ *yds. at* 6 *s.* 8 *d.*

240 *l.* 3 *s.* 4 *d. facit*

C. *qrs.* *l.*		*l.* *s.* *C.*
28—3—14 *at*		1——10
28 *l.* ——		1 *l.*
14 *l.* ——		10 *s.*
00—15*s.*		½ *C.*
7*s.* 6*d.*		¼ *C.*
3*s.* 9*d.*		14 *l.*
43 *l.* 6 *s.* 3 *d. facit*		

Man

Many more queſtions may be ſtated, and ſeveral her Rules of Practice may be ſhewn according to the ethod of divers Authors, but what have been de- vered here are ſufficient for the practical Arithme- ian in all Caſes whatſoever.

CHAP. XXVII.

The Rule of Barter.

BArter is a Rule amongſt Merchants, which (in the Exchanging of one Commodity for ano- r) informs them ſo to proportion their Rates as t neither may ſuſtain loſs.

2. To reſolve Queſtions in Barter, it will not be ficult to him that is acquainted with the Golden le, or Rule of 3, it being altogether uſed in reſol- g ſuch Queſtions.

Queſt. 1. Two Merchants, (*viz.* A and B) *Barter*, A h 13, C. 3 *qrs.* 14 *l.* of Pepper at 2 *l.* 16 *s. per* C. B hath Cotton at 9 *d. per l.* I demand how much ton B muſt give A for his Pepper?

nſwer. 9 *C.* 1 *qrs.*

irſt, find by the Rule of 3, or, the Rules of *Pra- e* foregoing, how much the *Pepper* is worth, ing,

f 1 *C.* coſt 2 *l.* 16 *s.* what will 13 *C.* 3 *qrs.* 14 *l* ?

nſwer, 38 *l.* 17 *s.*

econdly, By the Rule of 3 ſay, if 9 *d.* buy 1 *l.* Cotton, how much will 38 *l.* 17 *s.* buy?

nſwer, $9\frac{1}{4}$ *C.* and ſo much Cotton muſt B give to A 13 *C.* 3 *qrs.* 14 *l.* of *Pepper* at 2 *l.* 16 *s. per Cent.* n the Cotton is worth 9 *d. per l.*

Queſt. 2. Two Merchants (A and B) *barter*, A hath Ginger worth 1 *l.* 17 *s.* 4 *d. per C.* but in *barter* he will have 2 *l.* 16 *s. per C.* B hath Nutgmegs worth 5 *l.* 12 *s. per C.* now I demand how B muſt rate his Nutmegs *per C.* to make his gain in *bar etr* equal to that of A ?

Anſwer, 8 *l.* 8 *s.*

Say, By the Rule of 3, If 1 *l.* 17 *s.* 4 *d.* require 2 *l.* 16 *s.* in *barter*, what will 5 *l.* 12 *s.* require in *barter* ?

Facit 8 *l.* 8 *s.*

Queſt. 3. A and B *barter*, A hath 120 yards of Broad-cloth worth 6 *s. per yd.* but in *barter* he will have 8 *s. per yd.* B hath Shalloon worth 4 *s. per yd.* Now I demand how many *yds* of Shalloon B muſt give A for his Broad-cloth, making his gain in *barter* equal to that of A ?

Anſwer, 180 *yds* of Shalloon.

Firſt (as in the laſt queſtion) find out how B ought to ſell his Shallon in *barter*, *viz.* ſay if 6 *s.* require 8 *s.* what will 4 *s.* require ?

Anſwer, 5 *s.* 4 *d.*

Thus you ſee that B muſt ſell his ſhalloon in *barte* at 5 *s.* 4 *d.* if A ſell his Broad-cloth at 8 *s. per yd.*

It remaineth now to find out how much Shalloo B muſt give for 120 yards of broad-cloth, which after the ſame method uſed to reſolve the firſt Queſtio of this Chapter is found to be 180, and ſo many *ya* of Shalloon muſt B give A for the 120 *yds.* of broad cloth.

Queſt. 4 A and B *bartered*, A had 14 *C.* of Suga worth 6 *d. per l.* for which B gave him 1 *C.* 3 *qrs.* o Cinnamon , I demand how B rated his Cinnamo *per l.*

Anſwer, 4 *s. per* pound.

Queſt. 5. A and B *barter*, A hath 4 Tun of Brand worth 37 *l.* 16 *s.* ready mony, but in *barter* he ha 50 l. 8 *s. per* Tun, and A giveth B 21 *C.* 2 *qrs.* 11⅓ of Ginger for his 4 Tun of Brandy, I deſire to kno how B ſold his Ginger in *barter per C.* and how muc it was worth in ready mony

Anſwe

Anſwer, For 9 *l.* 6 *s.* and 8 *d.* in Barter, and it was worth 7 *l. per Cent.* in ready money.

Queſt. 6. A and B *barter*, A hath 320 dozen of Candles at 4 *s.* 6 *d. per* dozen, for which B giveth him 30 *l.* in money, and the reſt in Cotten at 8 *d. per l.* I demand how much Cotten he muſt give him more than the 30 *l.*

Anſwer, 11 *C. qr.*

Queſt. 7. A and B *bartr*, A hath 608 yards of broad cloth worth 14 *s. per yd.* for which B giveth him 125 l. 12 s. ready money, and 85 *C.* 2 *qrs.* 24 l. of Bees Wax, now I deſire to know how he reckoned his Wax *per. C.*

Anſwer 3 l. 10 s. *per. C.*

CHAP. XXVIII.

Queſtions in Loſs and Gain.

Queſt. 1. A Merchant bought 436 yards of broad-cloth for 8 s. 6 d. *per* yard, and ſelleth it again at 10 *s.* 4. d. *per* yd. now I deſire to know how much he gained in the Sale of the 463 yards?

Anſwer, 39 l. 19 s. 4 d.

Firſt find out by the Rule of Three, or by practice how much the Cloth coſt him at 8 s. 6 d. *per yd.* which I find to be 185. l. 6 s. then by the ſame Rule find out how much he ſold it for, *viz.* 225 l. 5 s. 4 d. then ſubſtract 185 *l.* 6 s. which it coſt him, from 225 l. 5 s. 4 d. which he ſold it for, and their remaineth 39 l. 19 s. 4 d. for his gain in the Sale thereof.

Otherwiſe it may ſooner be reſolved thus, firſt find out how much he gained *per yd. viz.* ſubſtract 8 s. 6 d. which he gave *per yd.* from 10 s. 4 d. which he ſold it for *per yd.* the remainder is 1 s. 10 d. for his gains *per yd.* Then ſay, If 1 *yd.* gain 1 *s.* 10 *d.* what will 436 *yds.* gain ? the *Anſw.* by Practice, or the Rule of Three is 39 *l.* 19 *s.* 4 *d.* as was found before.

Queſt. 2. A Draper bought 124 *yds.* of Holland cloth, for which he gave 31 *l.* I deſire to know how he muſt ſell it *per yd.* to gain 10 *l.* 6 *s.* 8 *d.* in the whole Sale of the 124 *yds* ? Anſwer, at 6 *s.* 8 *d.* *per yd.*

And the price which it coſt him, (*viz.* 31 *l.*) to his intended gain, (*viz.* 10 *l.* 6 *s.* 8 *d.*) the ſum is 41 *l.* 6 *s.* 8 *d.* then ſay,

If 124 *yds.* require 41 *l.* 6 *s.* 8 *d.* what will 1 *yd.* require ? by the Rule of Three I find the Anſwer 6 *s.* 8 *d.*

Queſt. A Grocer bought 3 *C.* 1 *qr.* 14 *l.* of Cloves, which coſt him 2 *s.* 4 *d.* *per l.* and ſold them for 52 *l.* 14 *s.* I deſire to know how much he gained in the whole ? Anſwer 8 *l.* 12 *s.*

Queſt. 4. A *Draper* bought 86 Kerſeys for 129 *l.* I demand how he muſt ſell them *per* piece to gain 15 *l.* in laying out 100 *l.* at the rate ? Anſwer 1 *l.* 14 *s.* 6 *d.* *per* piece ; for,

As 100 *l.* is to 115 *l.* ſo is 129 *l.* to 148 *l.* 7 *s.*

So that by the proportion above, I have found how much he muſt receive for the 86 Kerſeys to gain after the rate of 15 *l. per C.* then to find how he muſt ſell them *per* piece. I ſay,

As 86 pieces are to 148 *l.* 7 *s.* ſo is 1 piece to 1 *l.* 14 *s.* 4 *d.* which is the number ſought.

Queſt. 6. A *Grocer* bought $4\frac{1}{4}$ *C.* of Pepper for 15 *l.* 17 *s.* 4 *d.* and (it proving to be damnified) is willing to loſe 12 *l.* 10 *s.* *per Cent.* I demand how he muſt ſell it *per l.* Anſwer 7 *d.* *per l.*

Subſtract 12 *l.* 10 *s.* the loſs of 100 *l.* from 100 *l.* and there remains 87 *l.* 10 *s.* then ſay,

As 100 *l.* is to 87 *l.* 10 *s.* ſo is 15 *l.* 17 *s.* 4 *d.* to 13 *l.* 17 *s.* 8 *d.* ſo much as he muſt ſell it all for to loſe after the rate propounded, then to know how he muſt ſell it *per l.* I ſay,

As 13 *l.* 17 *s.* 6 *d.* is to $4\frac{1}{4}$ *C.* ſo is 1 *l.* to 7 *d.*

Queſt. 6. A *Plummer* ſold 10 Fodder of Lead (each *dder* containing 19½ *C.*) for 204 *l.* 15. *s.* and gained ter the rate of 12 *l.* 10 *s. per* 100 *l.* I demand how much it coſt him *per C*? Anſwer 18 *s.* 8 *d.*

To reſolve this Queſtion add 12 *l.* 10 *s.* (the Gain *er Cent.*) to 100 *l.* and it makes 112 *l.* 10 *s.* then ay,

112 *l.* 10 *s.* is to 100 *l.* ſo is 204 *l.* 15 *s.* to 128 *l.*

Which 128 *l.* is the Sum it coſt him in all, then reduce your 10 *fodders* to half hundreds and it makes 390, then ſay,

As 390 half hundreds is to 128 *l.* ſo is 2 half hundreds to 18 *s.* 8 *d.* the price of 2 half hundreds, or one *C.* weight, and ſo much it ſtood him in *per C.* weight.

Queſt. 7. A *Merchant* bought 8 Tuns of Wine, which being ſophiſticated, he ſelleth for 400 *l.* and loſeth after the rate of 12 *l.* in receiving a 100 *l.* now I demand how much it coſt him *per Tun*? and how he ſelleth it *per gallon* to loſe after the ſaid rate? *Anſw.* it coſt 56 *l. per tun*, and he muſt ſell it at 3 s. 11 d. $2\frac{10}{21}$ *qrs. per gallon* to loſe 12 *l.* in receiving 100 *l.*

To reſolve this queſtion I conſider in the firſt place, that in receiving 100 *l.* he loſeth 12 *l.* therefore 100 *l.* comes in for 112 *l.* laid out, wherefore to find how much he laid out for the whole, I ſay,

As 100 *l.* is to 112 *l.* ſo is 400 *l.* to 448 *l.* and ſo much the 8 Tun coſt him, then to find how much it coſt *per tun*, I ſay,

As 8 is to 448 *l.* ſo is 1 to 56 *l.* the price it coſt *per Tun.*

Now to find how he muſt ſell it *per* gall. reduce the 8 Tuns into Gallons, they make 2016, then ſay,

As 2016 Gallons is to 400 *l.* ſo is 1 Gall. to 3 *s.* 11 *d.* $2\frac{10}{21}$ *qrs.* the price he muſt ſell it at *per* Gall. to loſe as aforeſaid.

Queſt. 8. A Merchant bought 8 Tuns of Wine, which being ſophiſticated, he is willing to ſell for 400 *l.* and loſeth at that rate 12 *l.* in laying out 100 *l.* upon the ſame, now I demand how much it coſt him *per* Tun ?

Here I conſider that for 100 *l.* laid out, he receiveth but 88 *l.* therefore to find what the 8 Tuns coſt him, I ſay,

As 88 *l.* is to 100 *l.* ſo is 400 *l.* to $454\frac{6}{11}$ the price it all coſt him, then to find how much *per Tun*, I ſay,

As 8 is to $454\frac{6}{11}$ *l.* ſo is 1 to $56\frac{9}{11}$, or 56 *l.* 16 *s.* 4 *d.* $1\frac{5}{11}$ *qr. per Tun.*

CHAP. XXIX.

Equation of Payments.

1. EQuation of Payments, it that Rule amongſt Merchants whereby we reduce the times for payment of ſeveral Sums of Money, to an equated time for the payment of the whole Debt, without Damage to Debtor or Creditor, and

The Rule is,

2. Multiply the Sums of each particular payment by its reſpective Time, then add the ſeveral products together, and their Sum divide by the total debt, and the quotient thence ariſing is the equated Time for the payment of the whole debt. Example

Queſt. 1. A is indebted to B in the Sum of 130 *l.* whereof 50 *l.* is to be paid at 2 months, and 50 *l.* at 4 months, and the reſt at 6 months, now they agree to make one payment of the total Sum, the queſtion is what the equated time for payment without Damage to Debtor or Creditor ?

To reſolve this Queſtion I multiply each payment by its time, *viz.*

50 *l. multiplyed by* 2 *mon. produceth* —— 100
50 *l. multiplyed by* 4 *mon. produceth* —— 200
30 *l. multiplyed by* 6 *mon. produceth* —— 180

The Sum of the Product is —— 480

Then I divide 480 (the Sum of the Products) by 130 (the total Debt) and the Quotient is $3\frac{9}{13}$ months for the time of paying the whole Debt.

Queſt. 2. A Merchant hath owing him 1000 l. to be paid as followeth, *viz.* 600 l. at 4 months, 200 l. at 6 months, and the reſt (which is 200 *l.*) at 12 months, and he agreeth with his Debtor to make one payment of the whole, I demand the time of Payment without Damage to Debtor or Creditor ?

600 *l. multiplyed by* 4 *months is* —— 2400
200 *l. multiplyed by* 6 *months is* —— 1200
200 *l. multiplyed by* 12 *months is* —— 2400

The Sum of the Product is —— 6000

nd the Sum of the products (6000) being divided y the whole Debt (1000 *l.*) quotes 6 months for the ime of payment of the whole Debt.

3. The truth of this Rule is thus manifeſt, if the tereſt of that Money which is paid by the equated time) after it is due, e equal to the intereſt of that mo- ey which (by the equated time) paid ſo much ſooner than it is re at any rate *per C.* then the Operation is true, other- iſe not. Example,

The Proof of the Rule of Equation of Payments.

In the laſt Queſt. 600 *l.* ſhould have been paid at 4 onths, but it is not diſcharged till 6 months (that is months after it is due) wherefore its intereſt r 2 months at 6 *per C. per Annum* is 6 *l.* and then

200 l. was to be paid at 6 months, which is the equated time for its payment, therefore no intereſt is reckoned for it, but 200 l. ſhould have been paid at 12 months, but it is to be paid at 6 months, which is 6 months ſooner than it ought, wherefore the intereſt of 200 l. for 6 months is 6 l. (accompting 6 l. *per Cent. per Annum*) which is equal to the intereſt of 600 l. for 2 months, wherefore the work is right.

Queſt. 3. A *Merchant* hath owing him a certain ſum to be diſcharged at 3 equal payments, *viz.* $\frac{1}{3}$ at two months, $\frac{1}{3}$ at four months and $\frac{1}{3}$ at 8 months, the queſtion is, what is the equated time for the payment of the whole Debt?

In queſtions of this nature, (*viz.* where the Debt is divided into equal or unequal parts) each of the parts is to be multiplyed by its time, and the ſum of the product is the Anſwer,

$\frac{1}{3}$ *multiplyed by* 2 *mon. produceth* $\frac{2}{3}$
$\frac{1}{3}$ *multiplyed by* 4 *mon. produceth* $1\frac{1}{3}$
$\frac{1}{3}$ *multiplyed by* 8 *mon. produceth* $2\frac{2}{3}$

The Sum of the Product is $4\frac{2}{3}$

which is $4\frac{2}{6}$ months for the equated time of payment.

If inſtead of the *fractions* (repreſenting the parts) you had wrought by the numbers themſelves (repreſented by thoſe parts) according to the firſt and ſecond Examples, it would have been the ſame Anſwer, as ſuppoſe the Debt had been 90*l.* then $\frac{1}{3}$ of it is 30 *l.* for each payment, *viz.* at 2, 4, and 8 months, then

30 *l. multiplyed by* 2 *mon. produceth* 60
30 *l. multiplyed by* 4 *mon. produceth* 120
30 *l. multiplyed by* 8 *mon. produceth* 240

The Sum of the product is 240

which divided by 90 (the whole debt) quoteth $4\frac{60}{90}$ or $4\frac{2}{3}$ months as before.

Queſt. 4. A Merchant oweth a Sum of Money to be paid $\frac{1}{2}$ at 5 Months, and $\frac{1}{4}$ at 8 Months, and $\frac{1}{4}$ at 10 Months, and he agreeth with his Creditor to make one total payment; I demand the time, without dammage to Debtor or Creditor? Work as in the laſt Queſtion, and you will find the Anſwer to be 7 Months.

Queſt. 5. *A* is indebted to *B* 640 *l.* Whereof he is to pay 40 *l.* preſent Money, and 350 *l.* at 3 Months, and the reſt (*viz.* 250 *l.*) at 8 Months, and they agree, to make an Equated time for the whole Payment; now I demand the time?

In queſtions of this Nature, (*viz* where there is ready money paid) you are (in Multiplying) to neglect the Money that is to be paid preſent, and work with the reſt as is before directed; and divide the Sum of the products by the whole Debt, and the Quote is the Anſwer: For here 40 *l.* is to be paid preſent, and hath no time allowed, and according to the Rule it ſhould be multiplied by its time, which is (0) therefore 40 times 0 is 0, which neither augmenteth nor diminiſheth the Dividend; wherefore (to proceed according to direction) I ſay,

350 *by* 3 *Months produceth* ——— 1050
250 *by* 8 *Months produceth* ——— 2000

The Sum of the product is ——— 3050

which divided by 640, the whole Debt, the Quote is $4\frac{49}{64}$ Months, the time of Payment.

Queſt. 6. *A* is indebted to *B* in a certain Sum, $\frac{1}{4}$ whereof is to be paid preſent Money, $\frac{1}{3}$ at 6 Months, and the reſt at 8 Months; now I demand the Equated time for the payment of it all?

Anſwer, $3\frac{1}{3}$ Months is the time of payment.

Queſt. 7. *A* is indebted to *B* 120 *l.* whereof $\frac{2}{3}$ is to be paid at 3 months, $\frac{1}{4}$ at 6 months, and the reſt at 9 months; what is the Equated time for the payment of the whole Sum?

Anſwer, At 6 $\frac{3}{4}$ months.

Queſt. 8 A is indebted to B 420 *l.* which is due at the end of 6 months, but A is willing to pay him 140 *l.* preſent, provided he can have the remainder forborn ſo much the longer to make ſatisfaction for his kindneſs, which is agreed upon, I deſire to know what time ought to be allotted for the payment of the 280 *l.* remaining?

To reſolve this Queſtion, firſt, find out what is the intereſt, of 140 *l.* for the time it was paid before it was due, at 6 *per Cent.* (or any other rate) (*viz* 6. months) and you will find it to be 4 *l.* 4 *s.* Then it is evident that the remaining 280 *l.* muſt be detained ſo much longer than 6 months as the while it may eat out that intereſt, *viz.* 4 *l.* 4 *s.* which is thus found out, *viz.* Firſt, ſee what is the Intereſt of 280 *l.* for a month, or any other time; but here we will take one month, and its Intereſt, for one month is 28 *s.*

Then by the Rule of Three, ſay,

As 28 *s.* is to 1 month; ſo is 84 *s.* to 3 months; ſo that the 280 *l.* remaining muſt be kept 3 months, beyond its firſt time of prymene, (*viz.*6 months) which added thereto, makes 9 months, at the end of which time A ought to make payment of the remainder.

CHAP. XXX.

EXCHANGE.

1. THE Rule of Exchange informeth Merchants how to exchange Moneys, Weights, or Meaſures of one Country into (or for) the Moneys, Weights, or Meaſures of another Country and when the Rate, Reaſon, or proportion betwixt the Money, Weights, or Meaſures of different Countryes is known, it will not be difficult for the practitioner that is well acquainted with the Rule of proportion (or Rule of Three) to reſolve any Queſtion wherein it is required

to Exchange a given quantity of the one kind into the ſame value of another kind.

2. In Queſtions of Exchange there is always a compariſon made between the Coyns, *&c.* of two Countries (or kinds) or of more.

3. In Queſtions where there is a compariſon made between two things, (whether they be Moneys, Weights, *&c.*) of different kinds or (Countries) there may be a ſolution found by a ſingle Rule of Three, as may appear by the following Example.

Queſt. 1. A Merchant at *London* delivered 370 *l. Sterling*, to receive the ſame at *Paris* in *French* Crowns; the Exchange $3\frac{1}{3}$ *French* Crowns *per* pound *Sterling*. I demand how many *French* Crowns ought he to receive?

In placing the numbers obſerve the 6 Rule of the 10 Chapter, which being done, the given numbers will ſtand thus,

l. *Crowns* *l.*
1 ——— $3\frac{1}{2}$ ——— 370

and being reduced according to the Rules of the 24 Chapter, will ſtand thus;

l. *Crowns* *l.* *Crowns*
As $\frac{1}{1}$ is to $\frac{10}{3}$ ſo is $\frac{370}{1}$ to $1233\frac{1}{3}$

So that I conclude he ought to receive $1233\frac{1}{3}$ *French* Crowns at *Paris* for 370 *l.* delivered at *London*.

Queſt. 2. A Merchant delivered at *Amſterdam* 587 *l. Flemiſh* to receive the value thereof at *Naples* in Ducats the Exchange $4\frac{4}{5}$ Ducats *per l. Flemiſh*. I demand how many Ducats he ought to receive?

The proportion is as followeth.

l. *Ducats* *l.* *Ducats*
As $\frac{1}{1}$ is to $\frac{24}{5}$ ſo is $\frac{587}{1}$ to $2817\frac{3}{5}$

So I find he ought to receive $2817\frac{3}{5}$ Ducats at *Naples* for the 587 *l. Flemiſh* delivered at *Amſterdam*.

Queſt. 3. A Merchant at *Florence* delivereth 3478 Ducatoons, to receive the value at *London* in pence, the Exchange $52\frac{1}{2}$ pence *Sterling per* Ducatoon; I demand how much *Sterling* he ought to receive?

The Proportion for Reſolution is,

$$\text{As } \overset{\text{Duc.}}{\tfrac{1}{1}} \text{ is to } \overset{\text{d.}}{\tfrac{107}{2}} \text{ ſo is } \overset{\text{Duc.}}{\tfrac{3478}{1}} \text{ to } \overset{\text{d.}}{186073}.$$

which is equal to 775*l.* $6\frac{1}{12}$ for the Anſwer.

I might here (according to the Cuſtom of Arithmetical Writers) lay down Tables for the Reduction of Foreign Coyns to *Engliſh*; but by Reaſon of their Inſtability (for they continue not at a conſtant ſtandard, as our *Sterling* Money doth, but are ſometimes raiſed, and ſometimes depreſſed) I ſhall forbear.

4. When there is a Compariſon made between more than two different Coyns, Weights, or Meaſures, there ariſeth ordinarily two different caſes from ſuch a Compariſon.

1. When it is required to know how many pieces of the firſt Coyn, Weight, or Meaſure are equal in value to a known number of Pieces of the laſt Coyn, Weight, or Meaſure.

2. When it is required to find out how many Pieces of the laſt Coyn, Weight, or Meaſure are equal in Value to a given Number of the firſt ſort of Coyn, Weight, or Meaſure.

An Example of the firſt Caſe may be this, V I Z.

Queſt. 4. If 150 pence at *London* are equal to 3 Ducats at *Naples*, and $4\frac{4}{5}$ Ducats at *Naples* make $34\frac{1}{2}$ Shillings at *Bruſſels*, then how many pence at *London* are equal to 138 Shillings at *Bruſſels*? *Facit* 960 *d.*

This Queſtion may be reſolved at two ſingle Rules of Three; for firſt I ſay,

If $\frac{3}{1}$ Ducats at *Naples* make 150 Pence *London*, how many Pence will $4\frac{4}{5}$ Ducats make?

Anſwer, 240 Pence.

By the foregoing Proportion, we have diſcovered that $4\frac{4}{5}$ Ducats at *Naples* make 240 Pence at

London: And by the Tenour of the Queſtion we ſee that $4\frac{4}{5}$ Ducats at *Venice* make $34\frac{1}{2}$ ſhillings at *Bruſſels*, therefore 240 *d*. at *London*. are equal to $34\frac{1}{2}$ *s*. at *Bruſſels*, (for the things that are equal to one and the ſame thing are alſo equal to one another) wherefore we have a way laid open to give a ſolution to this Queſtion by another Single Rule of Three, whoſe proportion is,

As $34\frac{1}{2}$ ſhillings at *Bruſſels* is to 240 pence at *London*, ſo is 138 ſhill. at *Bruſſels* to 960 pence at *London*, which is the Anſwer to the Queſtion.

An Example of the ſecond Caſe may be thus, VIZ.

Queſt. 5. If 40 *l*. *Averdupois* weight at *London* is equal to 36 *l*. weight at *Amſterdam*, and 90 *l*. at *Amſterdam* makes 116 *l*. at *Dantzick* then how many pounds at *Dantzick* are equal to 112 *l*. of *Averdupois* weight at *London*?

Anſwer, $129\frac{23}{25}$ pounds at *Dantzick*.

This Queſtion is likewiſe anſwered at two ſingle Rules of Three, *viz*. Firſt, I ſay,

As 36 *l*. at *Amſterdam* is to 40 *l*. at *Lond*.
So is 90 *l*. at *Amſterdam* to 100 *l*. at Lond.

And by the Queſtion you find that 90 *l*. at *Amſterdam* is 116 *l*. at Dantzick, and therefore 100 *l*. at London is likewiſe equal thereunto, wherefore again, I ſay,

As 100 *l*, at *London* is to 116 *l*. at *Dantzick*,
So is 112 *l*. at Lond. to $129\frac{23}{25}$ *l*. at *Dantzick*.

By which I find that $112\frac{23}{25}$ *l*. at Dantzick are equal to 112 *l*, *Averdupois* weight at *Lond*.

5. There is a more ſpeedy way to reſolve ſuch Queſtions as are contained under the two Caſes beforementioned, laid down by Mr. *Kerſey* in the third Chapter of his Appendix to Mr. *Wingate's* Arithmetick, where he hath given two Rules for the Reſolution of the Queſtions pertinent to the two ſaid Caſes.

6. But I ſhall lay down a general Rule for the ſolution of both Caſes; and firſt, let the Learner obſerve the following Directions in placing of the given terms, *viz*.

7. Let there be made two Columns, and in theſe Columns ſo place the given terms one over the other, as that in the ſame Column there may not be found two terms of the ſame kind one with the other.

Having thus placed the Terms, the General Rule is,

Obſerve which of the ſaid Columns hath the moſt Terms placed in it, and multiply all the Terms therein continually, and place the laſt product for a Dividend; then multiply the Terms in the other Column continually, and let the laſt product be a Diviſor, then divide the ſaid Divided by the ſaid Diviſor, and the Quotient then ariſing is the Anſwer to the Queſtion.

So the Example of the firſt of the ſaid Caſes being again repeated, *viz.* if 150 pence at **London** make 3 *Ducats* at *Naples*, and $4\frac{4}{5}$ Ducats at *Naples* make $34\frac{1}{2}$ ſhill. at *Bruſſels*, then how many pence at **London** are equal to 138 ſhillings at *Bruſſels*?

The terms being placed according to the *7th.* Rule will ſtand as followeth.

	A	B	
Pence at Lond.	150		
Ducats at Na-	$4\frac{4}{5}$	3	*Ducats at Na-*
Shill. at Bruſſ.	138	$34\frac{1}{2}$	*Shill. at Bruſſ.*

having thus placed the Terms that in either Column there is two Terms of one kind, then obſerve that the Column under A hath moſt terms in it, therefore they muſt be multiplyed together for a Dividend; viz. 150 mult. by $4\frac{4}{5}$ produceth $\frac{3600}{5}$ which multiplyed by 138 produceth $\frac{496800}{5}$ for a Dividend; then in the Column under B there are 3 and $34\frac{1}{2}$ which multiplyed together, produce $\frac{207}{2}$ for a Diviſor; then having divided $\frac{49600}{5}$ by $\frac{207}{2}$, the Quotient is 960 pence for the anſwer as before.

Again, let the Example of the ſecond caſe be again repeated, *viz.* If 40 *l.* Averdupois weight at **London** make 6 *l.* weight at *Amſterdam*, and 90 *l.* at *Amſterdam* make 116 *l.* at *Dantzick*, then how many pounds at *Dantzick* are equal to 112 *l.* *Averdupois* weight at **London**, The terms being diſpoſed according to the *7th.* Rule oregoing will ſtand thus,

	A	B	
l. at Lond.	40	36	*l. at Amſterdam*
l. at Amſt.	90	116	*l. at Dantzick*
		112	*l. at London.*

whereby I find that the Terms under *B* multiplyed ogether produce 467712 for a dividend, and the erms under *A*, *viz.* 40 and 90 produce 3600 for a Diviſor, and Diviſion being finiſhed, the quotient gieth $129\frac{3312}{3600}$ pounds at *Dantzick* for the Anſwer.

CHAP. XXXI.

Single Poſition.

1. NEgative Arithmetick, called the Rule of Falſe, is that by which we find out a truth, by numbers invented or ſuppoſed, and this is either ſingle or double.

2. The Rule of Single Poſition is when at once, *iz.* by one Falſe poſition, or feigned number, we ind out the true Number ſought.

3. In the ſingle Rule of Falſe, when you have made made choice of your poſition, work it according to the enour of the queſtion, as if it were the true number ought, and if by the ordering your poſition you ind the reſult either too much or too little you may hen find out the number ſought by this proportion ollowing, *viz.*

As the reſult of your poſition is to the poſition, ſo is the given number to the number ſought.

Example.

Queſt. 1. A Perſon having about him a certain number of Crowns, ſaid if the fourth and third and ſixth of hem were added together, they would make juſt 45, ow I demand the number of Crowns he had about him? ? *Anſwer*, 60 Crowns.

To reſolve this queſtion I ſuppoſe he had 24 Crown (or any other number that will admit of the like di viſion) now the fourth of 24 is 6, and the third is 8 and the ſixth is 4, all which parts (*viz.* 6, 8, and 4, being added together make but 18, but it ſhould b 45, wherefore I ſay by the Rule of Three,

As 18, the ſum of the parts is to the poſition 24 ſo is 45 the given number to 60 the true numbe ſought.

For the fourth of 60 is 15, and the third of 60 i 20, and the ſixth of 60 is 10, which added togethe make 45.

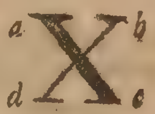
Queſt. 2. Three Perſons, *viz.* A. B, C, thus diſcourſe together concerning their Age, quoth B to A I am as old, and half as old again as you, then quoth C to B I am twice as old as you, then quoth A to them and I am ſure the Sum of all our Ages is 165, now demand each mans Age? *Anſwer*, A 30, B 45, C 90 years of Age, which added together, make 165.

CHAP. XXII.

Double Poſition.

1. THE Rule of Double Poſition is when 2 falſ poſitions are aſſumed to give a Reſolution t the queſtion propounded.

2. When any Queſtion is ſtated in double poſition make ſuch a Croſs as followeth.



3. Then make choice of any number you thin may be convenient for your working, which call you firſt Poſition, and place it at that end of the Croſs a 2, then work with this poſition (as if it were the tru numbe

umber ſought) according to the nature of your que-ion, then having found out your errour, either too uch or too little, place it on that ſide the Croſs *d*, hen make choice of another number of the ſame de-omination with the firſt poſition (which call your ſe-ond poſition) and place it on that ſide of the Croſs t *b*, then work with this poſition as with the former, nd having found out your error, either too much r too little, place it on that ſide of the *Croſs* at *c*, nd then the poſitions will ſtand at the top of the roſs, and the errors at the bottom, each under his orreſpondent poſition, and then multiply the errors nto the poſitions croſs-wiſe, that is to ſay, multiply he firſt poſition by the ſecond error, and the ſecond oſition by the firſt error, and put each product over s poſition.

4. Having proceeded ſo far, then conſider whe-er the errors were both alike, that is, whe-er they were both too much, or both too little, and they are alike, then ſubſtract the leſſer product from e greater, and ſet the remainder for a dividend, then bſtract the leſſer Error from the greater, and let the mainder be a diviſor, then the quotient ariſing by is Diviſion is the anſwer to the queſtion.

5. But if the errors are unlike, that is one too uch and the other too little, then add the products the poſitions and errors together, and their Sum all be a dividend, then add the errors together, and eir Sum ſhall be a Diviſor, and the Quotient ariſing nce is the Anſwer; which two laſt Rules may be pt in memory by this Verſe following, *viz.*

When Errors are of unlike kinds
  Addition *doth enſue,*
But if a like Subſtraction *finds*
  Dividing work for you.

Queſt. 1. A, B, and C build a Houſe which coſt l. of which A paid a certain Sum unknown, B paid

B paid as much as A, and 10 *l.* over, and C paid a much as A and B, now I deſire to know each man Share in that Charge?

Having made a Croſs according to the 2 Rule, come according to the third Rule to make choice o my firſt poſition, and here I ſuppoſe A paid 6 which I put upon the Croſs as you ſee, then B pai 16 *l.* (for it is ſaid he had paid 10 *l.* more than A) an C paid 22 *l.* for 'tis ſaid he paid as much as A and B then I add their parts.

l.		*l.*
9		A 6
19		B 16
28	120 168 288	C 22
56	6 X 9 12) (14 32 20	*Sum* 44
76	12	76
56		44
20		*error* 32

and they amount to 44, but it is ſaid they paid 76 wherefore it is 32 too little, which I note down a the bottom of the Croſs under its poſition for the fir error.

Secondly, I ſuppoſe A paid 9 *l.* then B paid 19 and C 28 *l.* all which added together, make 56, bu they ſhould make 76, wherefore the error of th poſition is 20, which I put at the bottom of the Cro under his poſition for the ſecond *Error*, then I mult ply the *Errors* and the *Poſitions* Croſs-wiſe, *viz.* 3 (the *Error* of the firſt *poſition*) by 9 (the ſecond *po tion,*) and the product is 288. Then I multiply 2 (the *Error* of the ſecond *poſition*) by 6 (the firſt *poſitio* and the product is 120.

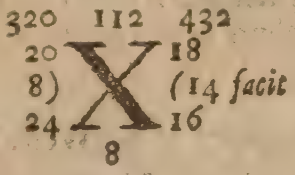
Then (according to the 4*th.* Rule) I ſubſtract th leſſer Product from the greater, (*viz.* 120 from 28 becauſe the *Errors* are both alike, *viz.* too littl

an

and there remaineth 168 for a Dividend, then I ſubſtract 20, (the leſſer *Error*) from 32 (the greater *Error*) and the Remainder is 12, for a Diviſor, then divide 168 by 12, and the Quotient is 14 for the Anſwer, which is the ſhare of A in the Payment.

6. Again Secondly, If the errors had been both too big it had had the ſame effect, as appeareth by the following work; for firſt I ſuppoſe A paid 20 *l.* then B paid 30 *l.* and *C.* 50 *l.* which in all is 100, but it ſhould have been no more than 76, wherefore the firſt Error is 24 too much. Again, I ſuppoſe A paid 18 *l.* then B muſt pay 28 *l.* and *C.* muſt pay 46 *l.* which in all

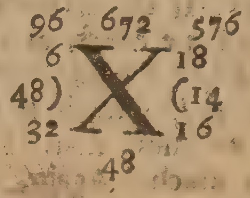
20 A
30 B
50 C
110 *ſum*
76 *ſubtr.*
24 *error*



A 18
B 28
C 46
ſum 92
ſubtr. 76
error 16

is 92 *l.* but it ſhould have been but 76 *l.* wherefore the ſecond *Error* is 16 too much; then I multiply 20 (the firſt *Poſition*) by 16 (the ſecond *Error*) and the product is 320, again I multiply 18, the (ſecond *Poſition*) by 24 (the firſt Error) and the product is 432. Then becauſe the Errors are both too much, I ſubſtract 320 (the leſſer product) from 432 (the greater product,) and there remaineth 112 for a Dividend, likewiſe I ſubſtract (16 the leſſer Error) (from 24 the greater Error,) and the difference is 8 for a Diviſor, then perform Diviſion, and the Quotient is 14, (as before) for the anſwer.

Again Thirdly, If the Errors had been the one too big, and the other too little, Reſpect being had to the 5*th.* Rule foregoing, the Anſwer would have been the ſame; as thus, I take for my firſt *Poſition* 6, and then the Error is 32 too litle, then I take for my ſecond Poſition 18, and then the error i 16 too much, then I multiply the Poſitions and errors Croſs-wiſe, and the products are 96 and 576, anc because the errors are unlike,



(*viz.*) one too big, and another too little, I add the products 96 and 576 together, and their Sum is 67 for a Dividend, I likewiſe add the errors 32 and 16 together, and their Sum is 48 for a Diviſor, then having finiſhed Diviſion, I find the Quotient to be 14, which is the anſwer as was found out at the 2 ſeveral Tryals before.

For proof of the Work I ſay,

l.
If A *paid* ——————————————-14
Then B *paid* 14 *and* 10 (*that is*) ——--24
Then C *paid* 14 *and* 24 (*that is*) ————38

The Sum of all is——————————————76

which is the total value of the building and equal to the given Number.

Thoſe who deſire to ſee the demonſtration of this Rule, let them read the 7*th.* Chap. of Mr. *Kerſeys* Appendix to *Wingates* Arithmetick, *Fetiſcus* in the 5*th.* Book of *Trigonometria.* Or Mr. *Oughtred* in his *Clavis Mathematica.*

Queſt. 2. Three Perſons, A, B, C, thus diſcourſed together concerning their Age; quoth A I am 18 years of Age, quoth B I am as old as A and ½ C; and quoth C I am as old as you both, if your years were added together. Now I deſire to know the Age of each Perſon? Anſwer A is 18, B is 54, and C is 72 years of Age.

Queſt. 3. A Father lying at the point of Death, left o his 3 Sons, *viz.* A, B, C, all his Eſtate in Money, nd divideth it as followeth, *viz.* to A he gave $\frac{1}{2}$ wanting 44 *l.* to B he gave $\frac{1}{3}$ and 14 *l.* over, and to C e gave the Remainder, which was 82 *l.* leſs than the hare of B, now I demand what was the Sum left, nd each mans part? Anſwer, The Sum bequeathed as 588 *l* and whereof A had 250 *l.* B had 210 *l.* and had 128*l*.

Queſt. 4. Two perſons, *viz.* A and B had each in heir hands a certain number of Crowns, and A ſaid to , if you give me 1 of your Crowns I ſhall have 5 mes as many as you, and ſaid B to him again, if you ive me one of yours, then we ſhall each of us have n equal number; now I demand how many Crowns ad each Perſon? Anſwer, A had 4, and B had 2 rowns.

Queſt. 5, What number is that unto which if I dd $\frac{1}{4}$ of it ſelf, and from the Sum ſubtract $\frac{1}{8}$ of it lf, the Remainder will be 210? *Anſwer*, 192.

Many more queſtions may be added, but theſe well nderſtood, will be ſufficient, (even for the meaneſt apacity) for the Reſolution of any other queſtion ertinent to this Rule.

There may be an objection made becauſe we have t treated particularly upon Intereſt and Rebate, but e operation of ſuch Queſtions being more applicable Decimals, are omitted, till we come to acquaint the earner therewith.

192
d23
11
12

Laus Deo Soli.

FINIS.

192
46
240
30
210

5

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